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Nachlaß von Prof. N. Malta

Granens föryngringssvårigheter på örtrik mark och dess orsaker.

Förelöpande meddelande.

Av Henrik Hesselman.

På rik lövskogsmull och andra marker med väl utbildad örtrik markvegetation visar granen mycket god trivsel och tillväxt, om den blott lyckas komma in, men den kan blott med svårighet kolonisera sådana ståndorter. Många rika lövskogs- och lövängsmarker ha blivit granskog, och dessa granskogar bruka vara särdeles produktiva. Man har å andra sidan velat påstå, att granen saknar förmåga att inträngа i lövängar, såvida dessa icke betas. Detta är visserligen oriktigt (jfr exempelvis Romell 1938, s. 324), men det råder obestridligen ett egendomligt motsatsförhållande mellan den späda granplantans och den mera försigkomna granens förmåga att hävda sig på örtrik mark och tillgodogöra sig markens näringsrikedom. Detta visar sig även på av barrskog bevuxen mark, där humustillståndet blivit så gott, att en örtrik flora invandrat. Så är i betydande utsträckning fallet i danska och sydsvenska kulturgranskogar, underkastade modern intensiv skötsel. Icke minst härigenom har frågan om granens föryngringsbetingelser på örtrik mark blivit ett skogligt problem. Frågan har, oavsett dess skogliga vikt, en icke ringa geobotanisk betydelse. Med tanke härpå torde intresse kunna påräknas även hos en botanisk publik för en diskussion av orsakerna till granens föryngringssvårigheter på örtrik mark och en kortfattad redogörelse för de hittills icke publicerade försök, som jag vid Statens skogsförsöksanstalt har anställt för att belysa denna fråga.

Den omedelbara iakttagelsen ute i skogen hänvisar ofta klart till den skuggande, frodiga markvegetationen såsom ett avgörande hinder för späda granplantors utveckling på örtrik mark. Belysande är Morks (1927) skildring av granens föryngringsbetingelser på näringsrik mark i Namdalen i Norge. Han omtalar först, att högvuxna ormbunkar och örter sådana som stormhatt, älggräs och midsommarblomster komma

in även i små luckor, och »er de først kommet, er granforyngelsen utelukket helt til bjerken tar overhand, men det tar meget lang tid.» Om det i de ogräsbesvärade luckorna alls finns några granplantor, så »er de henvist til gamle fall og stubber som er så store, at de raker op i højde med toppene av denna vegetasjon», vilken blir mer än meterhög. JUNCKER (1930) har diskuterat humustillståndets inverkan på granens trivsel och utveckling i danska kulturgranskogar. Han anser unga granplantor i och för sig rentav tacksammare än den äldre granen för ett gott mulltillstånd med salpeterbildning i marken. De unga plantorna »kan vel vokse respektabelt, hvor rigeligt NH_3 staar till Raadighed, men optimal Vækst synes de først at naa, hvor en betydelig Nitrifikation finder Sted. Ældre Individer synes i højere Grad at kunne nøjes med NH_3, men ogsaa her betyder Nitrifikationen utvivlsomt et Plus», ty »de bedste Bevoksninger er de, der har den bedste Humustilstand». Beträffande föryngringen har JUNCKER funnit, att den »foregaar ubetinget lettest og bedst, hvor den ideelle Muldtilstand hersker», så länge det är fråga om konstgjord föryngring genom plantering. »Den eneste alvorlige Fare, der truer, er Overvoksning af Ukrudt». Granens självföryngring däremot »begunstiges næppe af den gode Muldtilstand; Spiringen foregaar ofte mærkværdig daarlig, och de spæde Planter bukker som Regel under for den Urtevegetation, der vil findes, hvor Lysforholdene tillader Rødgranplanten at leve».

Praktiska skogsmäns allmänna erfarenhet synes stödja de anförda författarnas uppfattning, att det är markvegetationen och icke markens beskaffenhet, som gör det svårt för granen att självså sig på örtrik mark. Det är exempelvis ett känt faktum, att ett mullartat marktillstånd och god tillgång på kvävenäring ingalunda verkar skadligt på granplantor i plantskolor, utan tvärtom. Den rika mullen visar sig ogynnsam blott ute i de bevuxna markerna. Även där är den ogynnsam blott för alltför små granplantor, som lätt »kvävas» av markvegetationen. Där föryngringen med gran på rika marker försvåras av en frodig markvegetation, brukar man tillgripa plantering med äldre plantor än vanligt, och planteringen brukar lyckas, om blott plantorna äro nog stora.

En från den vanliga helt avvikande uppfattning om orsakerna till granens föryngringssvårigheter på örtrik mark har dock hävdats av LINDQUIST (1932), som visserligen tillmäter konkurrensen från markvegetationen stor betydelse, när det är fråga om krustätel (s. 10, 18, 19—20, 21), och även anser, att en vegetation av dominerande hallon m. fl. växter kan skugga ihjäl granplantor (s. 27), men likväl icke fin-

ner en rik markvegetation med harsyra eller hallon eller bäggedera vara nog för att vålla granplantornas dåliga tillstånd eller försvinnande i de fall, han närmare diskuterar (s. 10, 14, 16—17). Han anser sig under alla omständigheter kunna »fastslå, att plantornas otillräckliga förseende med ljus icke skulle kunna orsaka degeneration av granplantornas rötter av så allvarlig art, som i alla dessa fall konstaterats» (s. 27), och han söker i stället orsaken i marken, närmare bestämt i en alltför stark nitrifikation i humustäcket.

Klarhet i en dylik fråga torde icke stå att få genom okulär bedömning av i vad mån en viss markvegetation kan anses farlig och i vad mån en rotdegeneration måste tillskrivas andra orsaker än ljusbrist. Jag har därför sökt att belysa frågan genom en del kulturförsök, vilka pågått sedan år 1934. Försöken ha tillgått så, att frö bl. a. av gran har sått i olika slags jord, och kulturerna fått utveckla sig vid olika, väl kända bestrålningsstyrkor. I vissa serier ha krukorna vattnats med ammoniumnitratlösningar i olika koncentrationer. Här skola endast de försöksserier omtalas, som gälla gran, och av dem blott ett urval bland de på olika sätt varierade försöken, vilka i sin helhet givit synnerligen överensstämmande, entydiga och klara resultat.

I huvudförsöken användes följande olika jordar, vilka här ordnats efter deras nitratbildning per liter jord under tre månaders lagring i laboratoriet.

Beteckning	Härstamning	NO_3-bildning		
		p_H	mg N 3 mån.	
			pr kg	pr l
Ekmull	Experimentalfältet, örtrik eklund med hagtorn och hägg	4,9	115	86
Kongamull	Konga klint, Kågeröd, granskog med riklig harsyra	4,5	128	84
Alkärrsmull	Experimentalfältet, kärrartad allund med kraftig nässelvegetation	4,8	295	69
Bokmull	Maltesholm, bokskog med *Asperula, Cardamine impatiens* m. m.	6,0	31	30
Trädgårdsjord	Experimentalfältet	7,3—7,5	17	20
Ca-rik Ombergsmull	Omberg, granskog med riklig *Mercurialis*	7,2	21	9
Råhumussand (1 : 2)	Danderyd, barrblandskog m. blåbär	4,9	5	6
Sur Ombergsmull	Omberg, sluten granskog m. mossor	4,7	0	0

Granfrö såddes om våren i dessa olika jordar, och kulturerna fingo växa vid olika stark beskuggning, vartill samma installation användes som förut använts, beskrivits och avbildats av GAST (1936, s. 594). Bestrålningens styrka jämförd med den på fritt fält bestämdes genom fortlöpande mätningar. Strålningsstyrkor anges i det följande i bråkdelar av instrålningen på fritt fält.

Instrålningen på fritt fält, i växthuset och i de olika beskuggningsburarna mättes medels fortlöpande bestämningar med AURÉNs (1937) solarimeter. De meddelade värdena utgöra medeltalet av fortlöpande dygnsobservationer under månaderna juni—augusti åren 1935 och 1936.

Plantornas utveckling följdes fortlöpande, så att det kunde fastställas, hur många av de grodda plantorna gingo ut. Under första året var avgången följande, uttryckt i procent, antingen (för sommaren) av hela antalet grodda plantor eller (för vintern) av det antal plantor, som var kvar vid vegetationsperiodens slut.

Avgångsprocenter vid beströlningsstyrkan	under sommaren				under vintern			
	0.49	0.23	0.12	0.06	0.49	0.23	0.12	0.06
Ekmull	3	2	3	13	1	0	14	76
Kongamull	1	1	9	45	1	5	18	93
Alkärsmull	6	2	15	19	1	2	2	86
Bokmull	3	9	15	35	0	0	0	82
Trädgårdsjord	10	7	28	40	2	0	8	100
Ca-rik Ombergsmull	3	0	6	11	0	2	4	83
Råhumussand	1	5	5	18	2	5	21	76
Sur Ombergsmull	6	9	6	49	0	0	3	75

Avgångsprocenterna visa intet skönjbart samband med nitrifikationen, men starkt samband med beströlningsstyrkan. Intressant och upplysande är icke minst den mycket starka avgången under ett år vid en så pass hög beströlningsstyrka som 6 % av full instrålning (jfr LINDQUISTs ljusvärden s. 16, fig. 5; huruvida dessa uppmätts ovanför eller under markvegetationen framgår ej av redogörelsen).

Plantornas utveckling varierade både med jordens beskaffenhet och med beströlningen, såsom framgår av följande sammanställning av skottmedelvikterna i mg hos plantor i de olika kulturerna efter den första vegetationsperiodens slut. Viktsuppgifterna avse plantornas ovanjordiska delar.

Skottmedelvikter: Bestrålningsstyrkor:	Friskvikt, mg				Torrvikt, mg			
	0.49	0.23	0.12	0.06	0.49	0.23	0.12	0.06
Ekmull	193	93	48	27	68	32	15	6
Kongamull	138	79	40	21	47	28	11	4
Alkärrsmull	174	74	35	21	58	25	11	5
Bokmull	111	79	42	24	42	26	12	5
Trädgårdsjord	106	69	37	22	38	24	12	5
Ca-rik Ombergsmull	71	52	33	21	26	18	10	5
Råhumussand	91	55	37	22	31	19	11	5
Sur Ombergsmull	158	79	36	21	57	27	11	4

Man ser, att plantorna genomgående voro svaga vid den lägsta bestrålningsstyrkan med plantvikter som i allmänhet ligga mellan $^1/_5$ och $^1/_{10}$ av den som uppnås vid den högsta bestrålningsstyrkan, i flera fall lägre än $^1/_{10}$. Plantvikten varierar föga för olika jordar vid den lägsta bestrålningsstyrkan, men mer och mer vid högre. Med undantag för den sura Ombergsmullen visar plantutvecklingen ett rätt gott positivt samband med jordens nitratbildning.

De vid svag bestrålning vuxna plantorna hade icke blott ovanjordsdelen sämre utvecklad, utan framför allt rotsystemet, såsom framgår av följande sammanställning av rotsystemets friskvikt i procent av hela plantans.

Rotmassa i % vid bestrålningsstyrkan	0.49	0.23	0.12	0.06
Ekmull	39	33	23	12
Kongamull	38	34	17	12
Alkärrsmull	36	34	21	12
Bokmull	52	35	18	12
Trädgårdsjord	52	39	19	10
Ca-rik Ombergsmull	47	39	24	13
Råhumussand	48	36	26	15
Sur Ombergsull	43	31	20	13

Samma sak visade sig, i förbigående sagt, även för tall, och den har för två amerikanska tallarter påvisats av MITCHELL & ROSENDAHL (1939). Alltför svagt ljus hämmar framför allt rotsystemets utveckling. Skillnaderna mellan de olika jordarna med avseende på rotsystemets relativa utbildning voro däremot, såsom man ser, jämförelsevis obetydliga. Vid tillräckligt stark bestrålning utvecklas rotsystemet normalt, både i de starkt nitratbildande och i de andra jordarna.

Granplantor uppdragna under ett ekbestånd med undervegetation av hägg och hagtorn och med en instrålning under månaderna juni—aug. av 0.07—0.08 visade i de använda försöksjordarna med hänsyn till storlek och rotutveckling den största överensstämmelse med plantorna i beskuggningsburen med instrålningen 0.06.

I vissa försöksserier har ammoniumnitrat genom vattning med lösningar tillsatts i olika mängder upp till mycket höga givor, så höga, att gränsen för nitratets direkta giftverkan på granplantorna med säkerhet borde vara nådd. För dessa försök användes i varje serie en och samma starkt nitratbildande jord. Följande sammanställning visar resultaten av en försöksserie med alkärrsmull efter en vegetationsperiod. Med »befintligt nitratkväve» menas mängden på hösten, då försöket avbröts.

Tillsatt N i *gram* per		Befintligt nitrat-N, *gram* per		Avgångsprocenter vid bestrålningsstyrkorna				Skottmedelvikter (friskvikt mg) vid bestrålningsstyrkorna			
kg jord	liter jord	kg	liter	0.49	0.23	0.12	0.06	0.49	0.23	0.12	0.06
0	0	0.1—0.2	0.02—0.04	1	3	9	14	95	56	34	17
1—2	0.2—0.4	0.6	0.1	4	9	9	37	122	67	29	11
3—6	0.6—1.2	1.0—1.1	0.2	3	8	8	32	151	69	35	16
8—16	1.6—3.2	icke bestämda		3	16	17	72	icke bestämda			
24—48	4.7—9.6	5.4—6.5	1.1—1.4	100	100	87	100	—	—	36	—

Rotmassan utgjorde i procent av totala friskvikten vid den högsta bestrålningsstyrkan 26—28 %, vid den därnäst lägre 22—26 % och vid den lägsta bestrålningsstyrkan 12—13 %. Vid den näst lägsta bestrålningsstyrkan växla värdena från 11 % vid den högsta kvävetillsatsen till 21 % utan kvävetillsats.

Siffrorna visa en tendens till svagare utbildning av rotsystemet vid mycket riklig tillgång på kvävenäring. I princip samma sak har MITCHELL (1939) funnit hos plantor av weymouthtall, uppdragna i näringslösning. Det är också en sedan länge känd sak, att växtrötter gärna bli jämförelse långa i näringsfattig jord (BENECKE-JOST 1924, s. 160, not 54). Det torde närmast få uppfattas såsom en av de många regulationer, med vilkas tillhjälp växten i varje särskilt fall blir utbildad någorlunda i harmoni med betingelserna. Denna tendens betyder ingalunda, att plantorna degenerera vid bättre tillgång på kvävenäring. Tvärtom visa skottmedelvikterna, att vid tillräckligt ljus plantorna åtminstone upp till en nitrathalt motsvarande 200 mg N per liter jord utveckla sig kraftigare vid större nitrattillgång; vid de två lägsta ljusstyrkorna finnes ingen bestämd gång i siffrorna.

Avgångsprocenterna visa en tendens till ökning vid de högre kvävetillsatserna. För de två lägsta kvävetillsatserna är dock denna tendens delvis obefintlig (märk kolumnen för bestrålning 0.12). Först vid den näst starkaste kvävetillsatsen visar sig en ökning av avgångsprocenterna, som förefaller otvetydig, dock icke vid den högsta ljusstyrkan. Halten av nitratkväve i krukorna vid denna kvävetillsats blev tyvärr icke direkt bestämd, men den kan genom interpolering med ganska stor säkerhet anges till omkring 2000 mg per kg jord eller omkring 400 mg per liter. Gränsen för en tydlig och klar inverkan av höga nitrathalter på avgångsprocenterna torde därför i försöket kunna sättas vid omkring 2000 mg nitratkväve per kg av alkärrsjorden eller omkring 400 mg nitratkväve per liter jord. Detta är enorma värden, jämförda med dem som bruka uppträda i en naturlig jord. I skogen brukar man även i den rikaste mull och starkast nitratbildande hyggesjord icke träffa högre nitrathalter än allra högst motsvarande något enda tiotal eller några tiotal mg nitratkväve per liter jord (jfr HESSELMAN 1917 a, tab. 7, 1917 b, tab. 11 och 13, se även WEIS 1908 sid. 272).

Det gränsvärde, vid vilket enligt mina försök nitrathalten i jorden synes börja utöva en ofördelaktig inverkan på granplantor, vilken yttrar sig i märkbart stegrade avgångsprocenter, ligger alltså vid en nitrathalt av en annan storleksordning än de högsta nitratvärden, som bruka anträffas i skogsjord, även om jorden är synnerligen starkt nitratbildande.

Man torde med stöd av de utförda försöken få anse det klart, att den åtminstone tidigare bland skogsmän allmänna uppfattningen är riktig, enligt vilken granens föryngringssvårigheter på örtrik mark betingas av markvegetationen och icke av några för granen ofördelaktiga egenskaper hos marken såsom sådan.

Samtidigt ha försöken lämnat en nyckel till tolkningen av det intressanta förhållandet, att de örtrika markernas tynande, halvkvävda ungplantor av gran skilja sig från växtliga plantor icke minst däri, att rotsystemet blir synnerligen dåligt och icke normalt utbildat. Det har ju av försöken framgått, att ljusbrist hämmar rotsystemets utveckling mer än utvecklingen av plantans ovanjordiska delar. Utvecklingshämningen hos de dåligt närda rotsystemen inverkar också på mykorrhizans utbildning. Denna sak kommer framdeles att särskilt behandlas av fil. lic. ERIK BJÖRKMAN, som åtagit sig att behandla mykorrhizaförhållandena hos mina försöksplantor. I samtliga försöksjordar var mykorrhizan vid bestrålningsstyrkan 0.49 mycket väl utbildad, utmärkt av dominerande A- och B-mykorrhizor (se MELIN 1927). Vid

avtagande bestrålning avtog frekvensen av A- och B-mykorrhizor, men tilltog frekvensen av pseudomykorrhizor. De senares frekvens var också stor hos av markvegetation beskuggade (*Aegopodium, Scrophularia*) plantor i en för övrigt väl bestrålad kultur, bestrålning 0.76.

Vattningen med lösningar av ammoniumnitrat minskade mykorrhizabildningen hos plantor i alkärrsmullen, men denna minskning visade ett beroende såväl av tillförd mängd kväve som av bestrålningen.

Det förefaller sannolikt, att det framför allt är den dåliga mykorrhizabildningen hos de tynande plantorna på örtrik mark, som lett LINDQUIST till hans undervärdering av beskuggningens roll (jfr särskilt hans diskussion s. 10 om tynande granplantor i hallonsnår och hans bedömning s. 15—17 av granens föryngringsbetingelser i en lucka med 9—10 % ljus och rik markvegetation). Det måste medges, att det för den omedelbara iakttagelsen kan förefalla svårt att sammanknyta en dålig mykorrhizabildning med en primär skada genom ljusbrist. Med den kunskap man numera har om mykorrhizabildningens i många fall avgörande näringsfysiologiska betydelse (jfr litteratursammanställningen hos HATCH 1937 och även MC COMB 1938) ligger också den tanken rätt nära till hands, att den dåliga mykorrhizabildningen, såsom LINDQUIST hävdar, vore en primär orsak till plantornas dåliga tillstånd. Å andra sidan ha nyare erfarenheter bestyrkt den gamla uppfattningen, att barrträdsrötternas utrustning med mykorrhiza icke alltid är oumbärlig. MORK fann i Namdalen »meget sjelden» och »meget dårlig utviklet» mykorrhiza på rötterna av unga granplantor, som grott på uppkastad dikesjord och markbearbetade fläckar, men av hans korta beskrivning av dessa plantor (s. 57) tycks framgå, att de undersökta plantorna likväl voro kraftiga och goda, såsom de pläga vara på sådana ställen. MITCHELL fann vid kultur av weymouthtall i ren kvartssand dränkt med näringslösning, att plantorna höllo sig helt mykorrhizafria (s. 71), men likväl vid användning av tillräckligt näringsrika och lämpligt sammansatta näringslösningar blevo mycket bättre än i plantskolor (s. 128) och redan med 2 år voro betydligt större än ordinära 3-årsplantor ($^3/_0$ eller $^2/_1$) vuxna i plantskola (s. 132).

Då det visats, att rotsystemets abnorma utveckling hos tynande plantor kan vara direkt betingad av ljusbrist, har det sitt intresse att diskutera, hur brist på ljus kan tänkas vålla även den dåliga eller uteblivna mykorrhizabildningen. Det bör då påpekas, att den gamla uppfattningen, att trädens mykorrhizasvampar skulle i energetiskt avseende försörjas av sina värdträd och alltså i energiavseende vara parasiter på dessa, i varje fall för barrträdssvamparnas del synes vara den som

bäst redovisar för alla för närvarande bekanta fakta (jfr ROMELL 1939). Om denna uppfattning är riktig, blir det icke blott lätt att förstå, att ljusbrist och därav följande sparsam tillgång på assimilat kan störa den normala mykorrhizabildningen, utan det förefaller nästan självklart, att så måste vara fallet. [1]

Det är emellertid icke säkert, att en örtrik markvegetation är ogynnsam för granens föryngring enbart genom sin beskuggning. Vissa av mina försöksresultat tala i själva verket för att ytterligare någon faktor är med i spelet. För att så direkt som möjligt experimentellt pröva markvegetationens inverkan har jag i flera, under tre år upprepade försök haft harsyra med i kulturerna. Harsyran visade sig vid alla prövade bestrålningsgrader (6 %, 12 %, 23 % och 49 % av full bestrålning) ständigt och fullständigt omöjliggöra granplantornas utveckling, detta även när blott små plantor av harsyra planterades samtidigt som granfröet såddes. De granplantor, som överhuvud kommo upp, voro ytterligt svaga, och i intet av försöken överlevde någon enda granplanta första vintern. Om detta kan förklaras genom den vid alla ljusstyrkor utom den lägsta starka beskuggningen från den frodiga harsyrematten, så förefaller det dock svårt att som en verkan av beskuggning förklara, att redan g r o n i n g e n var vida sämre i krukorna med harsyra än i jämförelsekrukorna. En stor del av de groende fröna överlevde icke groningsstadiet. Detta är så mycket mer anmärkningsvärt, eftersom för övrigt groningen har varit ganska jämn i mina försök, oberoende av belysningsgraden och den använda kulturjorden. Vilken annan faktor än ljuset, som här kan vara med i spelet, kan uppenbarligen endast avgöras genom fortsatta undersökningar. Det visade sig också att den vid bestrålningsstyrkan 6 % g l e s a o c h s v a g t u t v e c k l a d e *Oxalis*mattan hindrade plantutvecklingen och ökade avgångsprocenten icke blott hos gran utan även hos sådana lövträdsplantor som hägg, ask och rönn i jämförelse med kulturerna utan *Oxalis* vid samma bestrålningsstyrka.

Anförd litteratur.

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BENECKE, W., & JOST, L., 1924. Pflanzenphysiologie, Bd I. Jena.

[1] Att LINDQUISTS uppfattning är oriktig, enligt vilken mykorrhizabildningen grundar sig helt enkelt på en tillväxtämnessymbios, förefaller klart redan på grund av MITCHELLS ovan refererade resultat.

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Some new species and forms of the Diatom genus Eunotia Ehr. 1837.

By Åke Berg.

Occupied with a monograph on the Diatom genus *Eunotia,* a genus, which beside the Pinnulariae dominates in the Fennoscandian forest and peat bog districts, I have found a large number of new or incompletely known forms, besides which a great percentage of the forms known of old have been readjusted thoroughly. Most of these new forms derive from Örträsk and Lycksele parishes in southern Lappland. I have had the good fortune in finding a considerable number of forms, which in a happy way are calculated to elucidate parts of the phylogenetic history of this genus. In the following I give a preliminary report of the new forms and denominations.

I have for intention to continue this work by means of monographs on the large Diatom genera, thus finally getting materials to an extensive Swedish flora on fresh-water diatoms. I am most thankful for diatomaceous stuffs from every part of our country, containing fresh-water diatoms, together with records about locality etc.

List of new or newly defined forms.

N. B. all dimensions are given in μ (0.001 mm); the frequency of the striae in number per 10 μ.

Tribe I. *Proto-Eunotiae.*

E. discrepans n. sp. 25—80×4—7; striae 7—10. Slightly curved — almost straight; valve flat, with ends curved inwards the apical axis and furnished with thickenings, — more or less marked polar septa. Ends at times slightly dorsally inflated. No raphe or nodules visible. Striae parallel, irregular, at times somewhat denser at the ends. Side-line (»pseudo-raphe») low or invisible. Fig. 1: 1.

E. matrix n. sp. 20—30×5 $^1/_2$—6 $^1/_2$; str. 8. Dorsal margin rather high and evenly arcued, ventral line straight, ends rounded. Striae

robust, regular, parallel, slightly radiating at the ends. No raphe or nodules visible; side-line invisible. Fig. 1: 2.

Tribe II. *Ventruosae.*

E. Vivani n. sp. 12—19×5—7; str. 14—20. Dorsal line almost straight, ends rounded, on the under side at times (different forms?) somewhat withdrawn. Ventral margin strongly convex. End nodules at apex close below the straight median (side-)line. Striae rather coarse and irregular. Fig. 1: 3.

E. Viv. f. α. 15 $^1/_2$×5; str. 18. The outline an almost regular oval. Striae regular, fine, parallel. Side-line invisible. Fig. 1: 4.

E. Viv. f. β. 23×9 $^1/_2$; str. 20. Coincides with main type as to the outline. Side-line straight, end nodules feeble, end nodule area distinct and well limited. Raphe end well visible, curved, reaching up to centre of apex. Striae rather sharp and regular, parallel, radiating at the ends. Valve flat, shortly roundish.

E. lanceolata n. sp. 19—26×5 $^1/_2$—7; str. 8—12. Dorsal line more strongly convex than the ventral one. Ends obtuse — somewhat acuminated. End nodules withdrawn from apices, inner nodules generally visible. Side-line straight. Striae closer and slightly radiating at the ends. Fig. 1: 5.

E. mira n. sp. 14—16×4—5; str. 17—20. Dorsal line abruptly rising from the ends, then straight, but slightly inflexed ($^1/_2$ μ) in the midst. Ends acuminated, bent downwards; in the fold between them and the rather strongly convex ventral margin lies the nodules as small luminating triangles. The raphe not clearly visible; striae fine, distinct, parallel or somewhat radiating, with a few short dorsal ones. Fig. 1: 6.

E. m. f. α. 14×7; str. 13. (lat. of var. not known). Dorsal line strongly arcuated; the valvular part above the side-line forms more than the half of an oval. Fig. 1: 7.

E. m. f. β. 7—9×3—3.3; str. 28+. Oval, with or without a delicate depression on the dorsal line. Ends broadly rounded. Nodules at apex, close below the median line of the valve. Striae fine, sharp, parallel. Side-line quite high, parallel with the ventral line. Fig. 1: 8.

E. traversa n. sp. 28×4; str. 21. Valve flat but rather robust. Dorsal line quite straight, ends rounded, not detached. Ventral line between the well marked inner nodules convex, but outside them

parallel with dorsal line. End nodules strong, in the lower angle of apex. Side-line high, straight. Striae sharp, quite parallel. Fig. 1: 9.

E. testudinata n. sp. 45—65×17—20; str. 9 $^1/_2$—11. Valve quite flat with a narrow marginal vaulting; dorsal line strongly arcuated. Ends softly detached on dorsal side, rounded. Ventral line an even convex line. End nodules small, in apex. The raphe not visible in valvular view, somewhat withdrawn towards the central axis, short, straight but twisted, the end bent down in a right angle. Side-line straight between the nodules, and thus rather high. Striae straight, parallel, robust, finely striated, of the same breadth as the interstices. Fig. 1: 10.

Tribe III. *Subtiles.*

E. angusta (Gr.). Syn. E. parallela Ehr. f. angustior Gr. 40—160× 5—7; str. 10—13. Lineal, arcuated, margins parallel; dorsum generally with a slender upwards bow at the ends. End nodules very delicate, marginal, in the lower angle of the valve. Striae not quite regular. Side-line very low, partly indistinct. Fig. 1: 11.

E. ang. f. α. 16—36×5—6; str. 10—14. Geniculated and generally with a rounded incision in the midst of the ventral margin. Ends not at all detached, broadly rounded. Striae more irregular than in the main form, often curved. Side-line higher, running straight from the nodules to the median incision. Fig. 1: 12.

E. ang. f. β. 50—75×6—9; str. 9—12. Coincides with the main form but for the generally somewhat thickened ends which are genuflexed; the median part of the ventral margin straight. Fig. 1: 13.

E. ang. f. γ. c:a 50×6; str. 10—11. Like the preceding, but ventral margin with a median embossment, with an incision on each side. Dorsal line a smooth curve. Fig. 1: 14.

E. ang. f. δ. 80—90×7(4). Like the main form, but the ventral margin with a median point. Fig. 1: 15.

E. ang. f. ε. 130—150×5—5$^1/_2$; Like the main form, but margins with a number of symmetrically placed, shallow incisions. Fig. 1: 16.

E. ang. f. *bilunaris* (Gr.). 80—120×5; str. 13. Like the main form, but the valve bracket-like depressed in the midst. The side-line runs straight over the bend of the ventral line.

E. ang. f. ζ. 70—80×4 $^1/_2$—5. A slender form; the valve somewhat tapering towards the ends. Fig. 1: 17.

E. ang. f. η. 60—70×5; str. 15—18. Coinciding with the precedent, but with denser striation. Fig. 1: 19.

E. ang. f. ϑ. 45—55×8—9; str. $9^1/_2$—10. Somewhat more robust and whit the striae more defined than the head form, — in these respects it approaches towards *E. parallela.* Fig. 1: 20.

E. ang. f. ι. 35—75×4—$4^1/_2$; str. 12—14. Very slightly arcuated, margins parallel, ends centrally acuminated. End nodules not visible, the raphe extremely fine. Striae at times somewhat radiating towards ends. Fig. 1: 18.

E. pectinalis Rbh. f. *Huglii.* 50—80×8—9; str. 9—11. Differs from f. (var.) *undulata* Ralfs by its robust ends, well-nigh capitate and somewhat acuminated; end nodules more powerful than in the main form. Fig. 1: 21.

E. pect. f. *cristula.* 25—35×7; str. 9—10. Dorsal line relatively high, with 3—4 ridges, ends rather thin, ventral line slightly concave, by a central point divided in two flat arcs. Fig. 1: 22.

E. pect. f. *didymodon* (Gr.). Syn. *E. camelus* Ehr. var. β *didymodon* Gr. 1865. — 25—35×$5^1/_2$—6; str. 12. Dorsal line high, with a median short impression, and the lateral parts obliquely cut off by a straight line. Ends thin, produced. Fig. 1: 23.

E. pect. f. α. 35—75×6—8. An undecided type, essentially agreeing with the main form, but ventral line showing a median, very delicate, more or less undistinctly limited embossment. — To this type I have also referred a New-Guinean form with only just visible median thickening, the shoulders on the dorsal margin all but deleted, striae 12, denser towards the ends. Fig. 1: 25.

E. pect. f. β. 40—70×6—7. The ends thickening towards capita-

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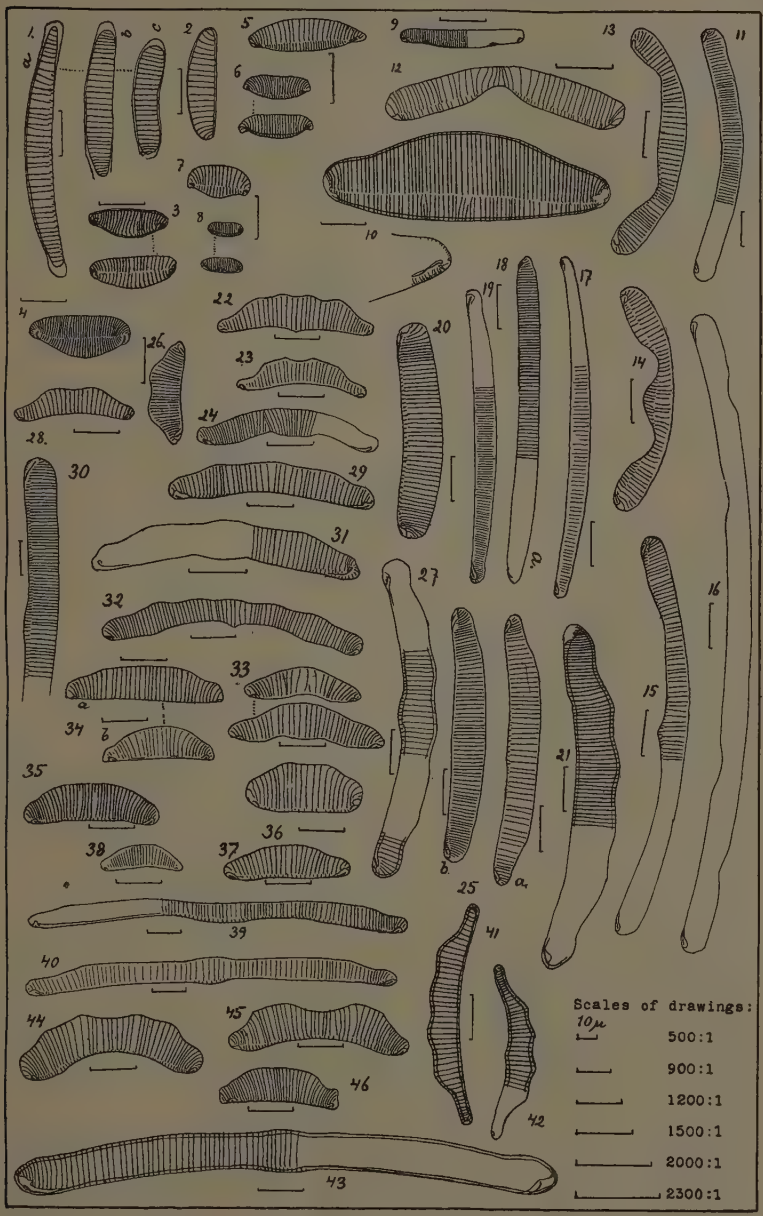
Fig. 1. 1 *Eunotia discrepans,* Örträsk. 2 *E. matrix,* Örtr. 3 *E. Vivani,* Örtr. 4 *E. Vivani* f. α, Örtr. 5 *E. lanceolata,* Cameroon. 6 *E. mira,* Örtr. 7 *E. mira* f. α, Spitzbergen. 8 *E. mira* f. β, Örtr. 9 *E. traversa,* Örtr. 10 *E. testudinata,* Herkinje l. 11 *E. angusta* (Gr.), Yarra Riv., Vict. 12 *E. ang.* f. α, Örtr. 13 *E. ang.* f. β, Örtr. 14 *E. ang.* f. γ, Örtr. 15 *E. ang.* f. δ, Örtr. 16 *E. ang.* f. ε, Örtr. 17 *E. ang.* f. ζ, Örtr. 18 *E. ang.* f. ι, New Guinea. 19 *E. ang.* f. η, Herkinje Lake. 20 *E. ang.* f. ϑ, Spitzbergen. 21 *E. pectinalis* f. Huglii, Bengal. 22 *E. pect.* f. *cristula,* Bengal. 23 *E. pect.* f. *didymodon* (Gr.), Oregon. 24 *E. pect.* f. γ, Örträsk. 25 *E. pect.* f. α, *a* Bengal, *b* New Guinea. 26 *E. pect.* f. λ, Bengal. 27 *E. pect.* f. *capitata,* Örtr. 28 *E. pect.* f. *sellula,* Brazil. 29 *E. pect.* f. β, Örtr. 30 *E. pect.* f. δ, Rostock. 31 *E. pect.* f. ε, Örtr. 32 *E. pect.* f. *undosa,* Örtr. 33 *E. pect.* f. ζ, Lake Vättern. 34 *E. pect.* f. *minor, a* Örträsk, *b* Herkinje Lake. 35 *E. pect.* f. η, Herkinje L. 36 *E. pect.* f. ϑ, Herkinje L. 37 *E. pect.* f. ι, Savoy. 38 *E. pect.* f. ϰ, Ringsjön, Scania. 39 *E. pect.* f. *biarcuata,* Småland. 40 *E. pect.* f. *gibbosa,* Isle of Lewis. 41 *E. camelus,* Brazil. 42 *E. cam.* f. *dentata,* Oregon. 43 *E. sumatrana* (Hust.), Brazil. 44 *E. siberica* f. *perarcuata* A. Cl.-E., Nuasjärvi. 45 *E. sib.* f. Stuxbergi, Jenissej. 46 *E. exeta,* Herkinje Lake.


Scales of drawings:
10μ
500:1
900:1
1200:1
1500:1
2000:1
2300:1

form; dorsal margin irregularly undulated, but generally with one central knob and accentuated shoulders. Ventral margin most frequently with a more or less central thickening. Fig. 1: 29.

E. pect. f. γ. 35—50×6; str. 15. Dorsal margin a smooth strong curve, ends gently recurved, ventral margin with a sharply limited median embossment. Fig. 1: 24.

E. pect. f. *sellula.* Syn. *E. camelus* Ehr. var. α *genuina* Gr. 1865. — 15—35×4½—6; str. 10—13. A rather robust type. Dorsal margin high, with two rounded ridges. Ends protracted, rather thin, ventral margin concave. End nodules extremely delicate, side-line not visible. Fig. 1: 28.

E. pect. f. λ. 23×7; str. 15—16. Dorsal margin very high, with two flattened undulations; ends somewhat acuminated. Ventral margin feebly concave. Fig. 1: 26.

E. pect. f. *capitata.* 50—90×5—7. A further development and settling of the f. γ. Dorsal margin with one (seldom 2) median knobs, and generally distinct shoulders; ends not narrowing, dorsally somewhat rounded capitate, more strongly built than otherwise. Ventral line whit a central nib or limited thickening. Fig. 1: 27.

E. pect. f. δ. 100×9; str. 10. Dorsal line smooth, only just curved, ends not detached, broadly rounded. Ventral line with a vag inflation. The raphe runs almost to apex on the valvular side. Side-line quite distinct. Valve flat. Fig. 1: 30.

E pect. f. ε. 40—55×7. Dorsal line equally divided by three flat undulations; ends dorsally feebly detached, obtuse and obliquely cut off, robust. Ventral margin with an embossment corresponding to that on the dorsum. The raphe rather high; side-line low. Fig. 1: 31.

E. pect. f. *undosa.* A slenderer type of the f. *biconstricta* with an odd number of undulations on the dorsum; the median thickening in the centre of the ventral margin acute. — An interesting parallel to *E. siberica.* Fig. 1: 32.

E. pect. f. ζ. 25—35×5—7; str. 8—11. An undecided, most varying type. Dorsal line rather strongly arcuate with feebly detached ends; ventral line slightly arcued with or without a central thickening. Fig. 1: 33.

E. pect. f. *media* (O. M.). 25—35×5—6; str. 13—15. Slightly arcued or only the ends bent down yoke-like; the short middle part of dorsal and ventral margins parallel. — It is with some hesitation I have called this rather undecided form by O. MÜLLER's name; the

present form is distinguished principally by its denser striation, and as to MÜLLER's form I have not found any statements about the striae.

E. pect. f. *minor* (Rbh.). (V. H. Syn. T. XXXIII: 15=*E. pect.* f. *curta* Gr, non fig. 20—21). — 12—35×6—8; str. 9—13. Dorsal margin as the main form; ends not always typically detached; ventral line straight or with small divergencies. — The end nodules are remarkably small but sharp, which at first prevailed me to set this form forth as a species of its own, presumably yet more primitive than the *pect. genuina,* and this also with regard to the fact, that the shoulders are not as well developed as in the last named. Fig. 1: 34 a.

To this form I have also referred one form from Herkinje Lake, N. Y., in which the dorsal margin runs further down towards the ends, which thus becomes lower. Ventral margin straight. Striae 11, more radiating. Fig. 1: 34 b.

E. pect. f. η. 25—35×8; str. 13. Dorsal line strongly arcued; ends rather high, undistinctly detached. Ventral margin somewhat withdrawn in median part. Striae radiating towards ends, side-line well visible. A few short dorsal striae. Fig. 1: 35.

E. pect. f. ϑ. 15—26×8—10; str. 9—11. Dorsal margins in the elongated forms with pronounced shoulders, in the shorter ones evenly arcued; ends thick. Ventral margin straight. Side-line visible. Fig. 1: 36.

E. pect. f. ι. 15—30×5—7; str. 10—13. Dorsal margin high with well marked shoulders or else falling in straight lines from centre. Ventral margin straight — concave. Striae feebly radiating. — A rather robust form. Fig. 1: 37.

E. pect. f. χ. 15—20×5; str. 17. Dorsal margin almost a smooth arc, ends somewhat acuminated; ventral line slightly concave. Striae radiating. Fig. 1: 38.

E. pect. f. *biarcuata.* 100—150×5—7; str. 7—10. Valve strongly elongated, and through a median depression divided in two flat arches. The valve generally thickest by the shoulders and the heels often well developed. The outline very varying. At times the ends are not at all detached, but of the same height as the dorsum. Side-line generally well visible, at least past the median ventral thickening. — One of the most striking forms is reproduced by LEWIS (1865) from White Mountains. Fig. 1: 39.

E. pect. f. *gibbosa.* 80—115×5—6; str. 8—10. An almost straight form with a short, limited thickening on dorsal and ventral margins. Fig. 1: 40.

E. camelus (Ehr. emend.). 30—50×6—7; str. 9—12. A slender and strongly arcued form. Dorsal and ventral margins parallel, the former showing 4 rounded ridges. Ends extended, thin, continuing the ventral arc. End nodules extremely feeble. Striae rather sharp, distinctly striated. Side-line not visible. Fig. 1: 41.

E. cam. f. *dentata.* Ventral margin divided in two arcs through a median nib. Strongly varying form. Fig. 1: 42.

Within the group camelus and hereto appertaining I have separated the 2-undulated *didymodon-sellula* from the type most conspicuous with 4 waves and for the last named adopted the old denomination *camelus* Ehr. GRUNOW (Banka 1865) divides EHRENBERG's very doubtful genus camelus in the following types: var. α *genuina* corresponding to my f. *sellula;* var. β *didymodon* which constitutes my *pectinalis* f. *didymodon;* var. γ *denticulata* corresponding to my *E. camelus.* — My division in one short form with two undulations and one more elongated with four waves, both of them with direct derivation from f. *undulata-camelus,* may be taken as a genetically better founded.

E. sumatrana (Hustedt emend.). 95—160×8—10; str. 8. Syn. *E. formica* var. *sumatrana* Hust. — A more developed form of *E. pectinalis* f. *capitata.* Gently curved, margins parallel or somewhat tapering towards the ends. The centre slightly bilaterally embossed. Ends slightly capitate, centrally or only by dorsal line. End nodules rather robust. Striae strongly irregular. Side-line visible. — The valve essentially more robust than the *pectinalis* forms (exc. f. *capitata*) with margins broader rounded. Fig. 1: 43.

The likeness to *E. formica* is superficial, — the thickening in the central part; neither end nodules, raphe or striae accord with those in formica. In return we have seen the close resemblance to *E. pectinalis* f. *capitata,* which has been derived without any gaps from *pectinalis genuina.*

E. siberica Cl. f. *perarcuata* A. Cl.-E. 1938 in man. The shortest forms of the main type, in which the central thickening on the ventral margin has disappeared. Fig. 1: 44.

E. sib. f. *Stuxbergi.* 35—45×9(6); str. 10—11. An undubitable *siberica,* where the dorsal margin has been simplyfied to two widely separated flattened undulations, thus forming a parallelism to *E. pect.* f. *didymodon.* Ventral margin one strong arc. Side-line visible. Fig. 1: 45.

E. exeta n. sp. 25—40×7—9; str. 15. Dorsal margin rather

strongly arcuate with rounded shoulders. Ends dorsally more or less strongly detached, abrupt. Ventral margin imperceptibly concave. Valve flat, shortly or not at all rounded margins. Striae strong, denser and somewhat radiating towards ends. Fig. 1: 46.

E. parallela Ehr. f. *media* A. Cl. 1895. 35—65×7$^1/_2$—9; str. 14—16. A short form of *E. parallela* with ends rounded, detached on dorsal side, and shoulders marked. — I have also noted a diminutive form (26×5) from Spitzbergen; its striae thickened considerably towards the ends.

E. lunaris (Ehr., Gr. emend.). 30—90×3—5; str. 15—18. The main type has margins well-nigh parallel, ends semi-circularly rounded, not or scarcely detached from dorsal margin, and not perceptibly inflated. Valve evenly arcued 1: 8—17). End nodules at the lower border of apex, with the upper point clear from the margin. Striae even, diffuse but distinct. — In this f. *genuina* furthermore enters one type with the median dorsal margin very slightly embossed.

E. lun. f. α. Syn. *E. elegans* Hust. 1924 s. 545, T. 18: 14, 15. — 32—34×2$^1/_2$; str. 19. Strongly arcuated (rise 1: 5—7$^1/_2$). Somewhat tapering towards the ends, which are softly detached dorsally. Robust type. — Differs from f. *capitata* Gr. only by its greater rise; if transitional forms are found this f. ought to be withdrawn as needless.

E. lun. f. β. 30—50×2$^1/_2$—3$^1/_2$; str. 17—18. Slightly arcued, from the centre tapering dorsally to the ends, which are plainly rounded, not inflated. End nodules a trifle more ventral than in the main form. Fig. 2: 47.

E. lun. f. γ. 29—43×2(5)—3(6); str. 17—18. Strongly arcued (1: 7—8), margins parallel, ends rounded, recurved, slightly narrowed. Ventral margin with a triangular embossement of the same height as the valve; the side-line visible past this embossment. End nodules as in f. β. Fig. 2: 48.

E. lun. f. δ. 40—65×4; str. 16—17. Valve with 1—2 bends downward, placed symmetrically or not (A. MAYER's *lusae bilunaris* and *serpentina*). Fig. 2: 49.

E. lun. f. ε. 15—35×4—5; str. 16—19. Straight or slightly arcued, with ends tapering or simply rounded. End nodules very delicate. The valve is characterized by both margins seemingly thicker in the median parts, and thinning out towards ends, — Possibly a recessional form; its systematical position is not clear. Fig. 2: 50.

E. lun. f. *elegans* (Östr. 1910. emend.). 23—33×2—3$^1/_2$; str. 17—20. Margins well-nigh parallel, strongly arcued (1: 3—4). Apices

capitate dorsally, sharp detached. End nodules very delicate, triangular. Striae delicate, visible only in a powerful refractive medium.

E. falcata (Bréb. emend.). V. H. Syn. T. XXXV: 6 c=*E. lun.* var. *excisa* Gr. (*Synedra falcata* Bréb). 20—40×4—5; str. 16—20. The primitive form consists of two arcs, the ventral one with greater radius than the dorsal; the proportions vary between 1: 1. 2 and 1: 2. Ends not detached, obtusely rounded. End nodules terminal, clearly subjacent, remarkably feebly developed. Striae regular, at right angle to ventral margin. Fig. 2: 51.

E. falc. f. α. 10—40×3½—5½. Ventral margin with irregular course; short forms often with ventral line straight but dentated. — Includes A. MAYER's *E. lunaris* var. *subarcuata* and his *lusae excisa* and *ceratoneoides*. Fig. 2: 52.

E. gracilis (Ehr., Rbh. 1864 emend.). 60—220×3½—5; str. 10—14. Lineal, gently arcued — straight, margins parallel, ends often but not always somewhat inflated symmetrically or only dorsally. Striae plainly transversely lined. Raphe as in *E. pseudo-pect.* with (sometimes indistinct) valvular raphe.

E. grac. f. α. 50—70×1—1.3; str. 13—15. Gently arcued, with ends dorsally capitate. Fig. 2: 53.

E. grac. f. β. 100—160×4—5; str. 10—14. Straight, somewhat tapering towards ends, which are elongated rounded and dorsally inflated. No valvular raphe, but from the end nodule a narrowing hyaline space (8—10 μ). The raphe does not run as high as in the main type. Fig. 2: 54.

E. grac. f. γ. 70—170×4½—5½; str. 13—14. Dorsal line straight, ventral line gently depressed in the midst. Ends bilaterally rounded inflated. Very little of the raphe visible in valvular view. Valvular raphe is at hand or not. The end pore well marked. Fig. 2: 55.

E. flexuosa (Kz. emend.). 90—300×4—5½; str. 15—19. Lineal, gently arcued, margins parallel. Ends not or vaguely inflated. Striae generally distinctly punctated. The raphe as in *E. pseudo-pect.*, with or without valvular raphe.

E. flex. f. α. 80—140×1½—2½; str. 18—19. Gently arcued or straight, with ends geniculate. Ends strongly bilaterally inflated. End nodules more robust than in the main type; distinct valvular raphe. — A parallel form to *E. gracilis* f. α. Fig. 2: 56.

E. flex. f. β. c:a 100×2½. — Almost straight; ends tapering to 1½ μ, not inflated. Fig. 2: 57.

E. flex. f. γ. 5—20×2; str. 25—26. Arcued, margins strictly parallel. Ends rounded, not inflated. Fig. 2: 58.

E. repens n. sp. 130×2—3½; str. 18—22. Main form lineal, feebly arcued, with not or slightly inflated ends. End nodules as in *E. pseudo-pect.,* but growing more subjacent in the formae. Forms that have been grasped as auxospores show essentially stronger withdrawn end nodules. Valvular raphe sometimes at hand. The valve exhibits generally irregular bows and jerks. Fig. 2: 59.

E. rep. f. α. 25—40×2—2.7; str. 20—21. Arcued, dorsally capitate. End nodules somewhat more subjacent. Fig. 2: 60.

E. rep. f. β. 90—105×3; straight, with geniculate ends, valve slightly narrower at the angles. Ends lengthened inflated. Fig. 2: 61.

E. rep. f. γ. 22—25×1 ½. Like the pecedent but of so small a size that it is considered to form a unit of its own. Fig. 2: 62.

E. rep. f. δ. 20—33×2 ½—3.2; str. 23—27. Margins strictly parallel; arcued, ends recurved almost horizontally for some stretch. Fig. 2: 63.

E. alpina (Naeg., Gr. emend.). V. H. Syn. T. XXXV: 5=*E. lunaris* var. *alpina* Gr. Rbh. Flor. eur. alg. p. 129=*Synedra alpina* Naeg. — A Mayer, Bayer. Eunot., p. 120=*E. Naegeli* Mig. 1907. 45—160×1½—3½; str. 23—28. Slightly arcued, evenly tapering towards ends (c:a 1 μ in height); the very ends gently inflated about to the height of the median part. End nodules extremely delicate, clearly subjacent. At times a valvular raphe can be discerned. Striae exceedingly delicate.

E. alp. f. α. 60—80×2; str. 30+. Like the main type, but with denser striation. (Whit regard to this it ought more properly to be advanced as a species of its own.)

E. subtilissima n. sp. 13—30×1½—2; str. valued 35+. Imperceptibly arcued, ends rather strongly recurved, margins strictly parallel. Striae only just visible (in monobromide of naphthalin). Nodules subjacent, scarcely visible. Fig. 2: 64.

E. paradoxa n. sp. 100—120×1½; str. 20. Extremely narrow and elongated, margins parallel, ends somewhat inflated. Raphe feebly developed, length 3 μ; distinct valvular raphe. Striae well visible. Fig. 2: 65.

E. caecigena n. sp. 9—50×2—6; str. 16+. This denomination has been advanced to cover a number of forms, unmistakeably belonging to *Subtiles,* but equally composed of several systematical unities, held together by lacking raphe and nodules, and a striation

of 16 or more. Striae vag and diffuse. Margins by the elongated forms parallel; ends not detached. — By the lacking of raphe and nodules, as well as the feeble striation, I have apprehended these forms a regressional, and then it seems quite as it should be, that they are owed to more than one systematical starting-point. *E. caecigena* does not represent a species, but a state. Fig. 2: 66.

A common trait in these types seems to be the frustules thinning out from centre towards ends, while the reverse otherwise is the case: the ends are more robust.

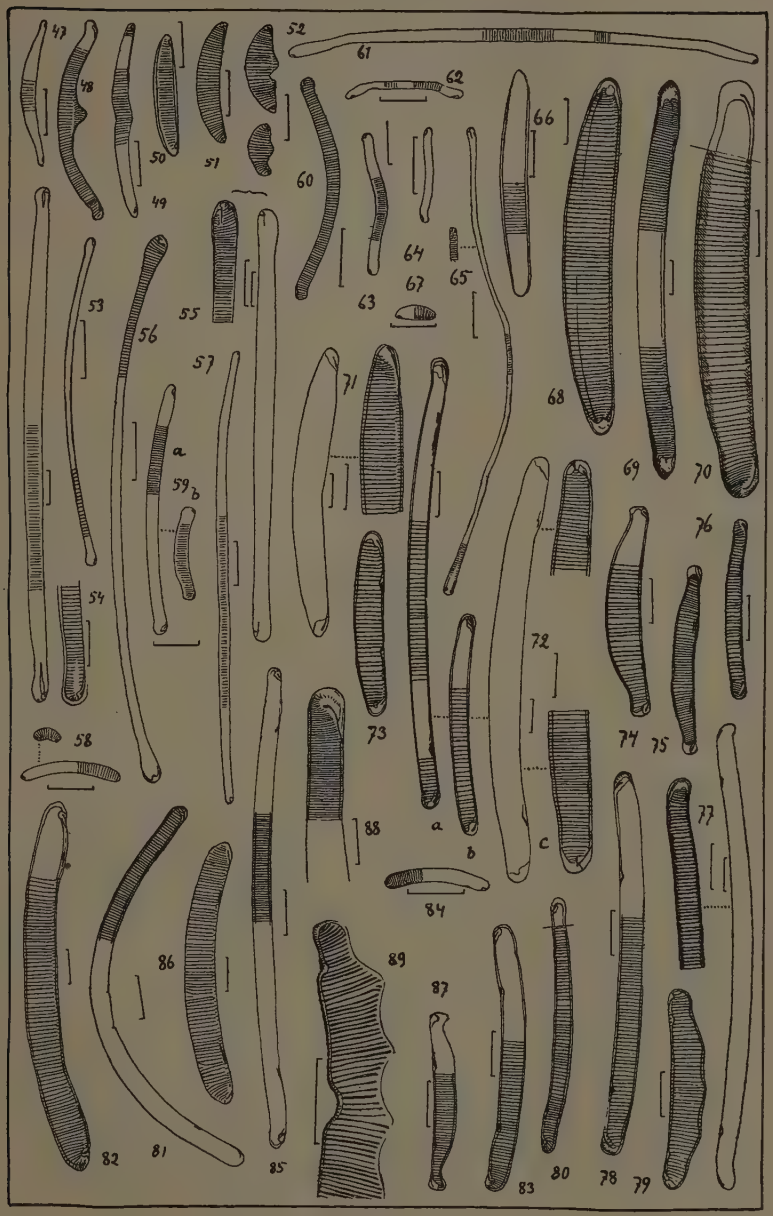
Doubtful species:

E. omega n. sp. 8—9×3; str. 30+. Dorsal margin strongly arcued, ventral margin slightly convex, ends not detached, rounded. End nodules subjacent, striae extremely fine and sharp, towards ends somewhat radiating. — It is only the absence of inner nodules that has induced me to place this form among the Subtiles. Fig. 2: 67.

Tribe IV. *Grunowiae.*

E. antiqua n. sp. 70—90×6—11; str. 10—11 $^1/_2$. Dorsal margin one smooth and flat arc; ends not detached, rounded obtuse, sometimes imperceptibly recurved. Ventral margin gently concave. Valve quite flat, supplied with polar septa with irregular inner limits and enclosing the end nodules. Raphe quite low on valvular side, delicate, sometimes not visible. Striae robust, regular, parallel, finely punctated. Side-line scarcely visible. The dorsal plane towards the poles rather appreciably depressed between the two apical planes. Fig. 2: 68.

Fig. 2. 47 *E. lunaris* f. β, Örträsk. 48 *E. lun.* f. γ, Örtr. 49 *E. lun.* f. δ, Örtr. 50 *E. lun.* f. ε, Bengal. 51 *E. falcata* Breb., Örträsk. 52 *E. falc.* f. α, Örtr. 53 *E. gracilis* f. α, Örtr. 54 *E. grac.* f. β, Rio Negro. 55 *E. grac.* f. γ, Rio Negro. 56 *E. flexuosa* f. α, Örträsk. 57 *E. flex.* f. β, New Guinea. 58 *E. flex.* f. γ, Örträsk. 59 *E. repens, a* W. Greenland, *b* Himalay. 60 *E. rep.* f. α, Örträsk. 61 *E. rep.* f. β, Örtr. 62 *E. rep.* f. γ, Örtr. 63 *E. rep.* f. δ, Örtr. 64 *E. subtilissima,* Örtr. 65 *E. paradoxa,* Örtr. 66 *E. caecigena,* Bengal. 67 *E. omega,* Örträsk. 68 *E. antiqua,* Örtr. 69 *E. ant.* f. α, Örtr. 70 *E. ant.* f. β, Cameroon. 71 *E. ant.* f. γ, Örträsk. 72 *E. Grunowi, a* Örträsk, *b* Lake Vättern, *c* Yarra Riv., Victoria. 73 *E. Grun.* f. α, Örträsk. 74 *E. Grun.* f. β, Lake Vättern. 75 *E. Grun.* f. γ, Örträsk. 76 *E. Grun.* f. *dispersa* (A. Cl.-E.), type with converging striae, Örträsk. 77 *E. Grun.* f. ε, Örträsk. 78 *E. Grun.* f. ζ, Örtr. 79 *E. Grun.* f. η, Örtr. 80 *E. Grun.* f. ϑ Cameroon. 81 *E. volvo,* Småland. 82 *E. pseudo-parallela,* Bengal. 83 *E. ps.-par.* f. α, Maine. 84 *E. ps.-par.* f. β, Örträsk. 85 *E. ps.-par.* f. γ, New Guinea. 86 *E. ps.-par.* f. δ, Jenissej. 87 *E. fallax* f. α, Örträsk. 88 *E. lapponica* f. α, Örtr. 89 *E. polyglyphis* f. α, Örtr.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E. ant. f. α. 100—120×7—8; Gently arcued, margins quite parallel, ends imperceptibly recurved, rounded — somewhat acuminated. Valve flat, but towards the ends still more roundish. Ends with polar septa c:a 5 μ, inwards irregularly limited. End- and inner nodules visible. The raphe fine, very low. Striae robust, regular, distinctly lined. Side-line distinct. Fig. 2: 69.

E. ant. f. β. 90—100×12; str. 8. Robust, with strongly roundish margins. Dorsal line arcued, slightly depressed before the ends, ventral line almost straight. Ends rather broad, rounded. The raphe high with a broad hyaline space. Striae somewhat irregular, denser and radiating at the ends. Side-line visible. The ends with polar septa reaching past the raphe. Fig. 2: 70.

E. ant. f. γ. 86×9; str. 11. Dorsal margin a smooth arc, ends obtuse, not detached. Ventral line slightly concave. Ends hyaline, end nodules very coarse. Raphe distinct, lengthened in line by a somewhat narrower part close up to apex. Striae regular, by the ends bent inward the nodules, robust, not lined. Side-line rather high. Fig. 2: 71.

E. Grunowi n. sp. 60—190×4—9; str. 10—12. A very robust form with valve roundish. Margins strictly parallel, slightly arcuated. Ends broad, rounded, sometimes slightly recurved. The ends seem to be strongly built with irregular hyaline areas at apex or, eventually, rudiments of polar septa. End nodules coarse, inner nodules generally visible. Raphe very distinct, running up to, sometimes past the apical axis. Side-line quite low, generally indistinct. Striae robust, a trifle irregular, lineated. Fig. 2: 72.

E. Grun. f. α. 40—90×4—9; str. 9—13. Includes a number of rather strongly varying forms, which by their robust ends, at times dorsally capitate, their coarse striae, their generally visible inner nodules give evidence of their connection with *Grunowi*. — Dorsal margin a trifle more arcuate, seldom parallel with the ventral one. Striae remarkably robust. Side-line generally well visible. Fig. 2: 73.

E. Grun. f. β. 35—100×8—9; str. 11—14. High and relatively short forms, dorsal margin often with a delicate median depression and more or less developed shoulders. Ends broad, rounded, slightly dorsally detached. Ventral line straight or imperceptibly concave. No s. c. polar septa. End nodules very coarse, raphe well visible as well as the inner nodules and the side-line. Striae almost regular, broad and glistening. — Calls to mind the praeruptae, but is told from them

by means of the high raphe and inner nodules; the habitus of the striae however reminds very much of those in *E. formica*. Fig. 2: 74.

E. Grun. f. *uplandica* A. Cl.-E. 1938 in man. 40—140×8 $^1/_2$—10; str. 9—11 $^1/_2$. Slightly arcued; margins parallel. Dorsal line with rounded shoulders tapering to the elongated ends, which at times are slightly recurved. Inner nodules feeble — indistinct. Striae rather regular, perpendicular to the ventral margin. Valve robust, with rounded margins. Fig. 5: 190.

E. Grun. f. γ. 25—41×4—5; str. 13—17. Slender forms; dorsal line straight or with a rather flat median impression. Ends prolonged, rounded — dorsally capitate. Ventral line straight or somewhat irregular. End nodules rather stout, inner nodules generally well visible. Valve robust, strongly rounded margins. Striae coarse, closer and radiating towards ends. — *E. impressa* Ehr is a more densely striated form of this one. Fig. 2: 75.

E. Grun. f. *dispersa* A. Cl.-E. 1934 (*E. fallax* var. *dispersa*). 20—70×2—4 $^1/_2$; str. 9—13. A. slightly arcued, slender form, generally tapering from the median part, though forms with parallel margins have also been met with. Margins rounded, ends slightly recurved, rounded — somewhat extended. Inner nodules rather delicate. Striae strictly parallel. Side-line well visible. — At some types included in this form has been noted that singular convergence in the terminal striae, which is given in *E. lapponica*. Fig. 2: 76.

E. Grun. f. ε. 60—140×5—8; str. 11—15. Slightly arcued, margins quite parallel and strongly rounded. Ends rather strongly recurved, rounded, scarcely contracting. Generally distinct polar septa. Length of raphe 15 μ. Inner nodules generally well visible. Side-line low but visible. Striae very coarse, almost regular, parallel until the middle of the raphe, where they, suddenly tightening, begin to converge upwards, thus running at right angle to the rising raphe. — An identical form, except lacking inner nodules, has been noted from Bengal. An extremely short, straight type of this form has been rarely found in Örträsk and Rostock; measures 25—41×5—5 $^1/_2$; str. 13—14. Fig. 2: 77.

E. Grun. f. ζ. 60—90×4 $^1/_2$—5 $^1/_2$; str. 12—15. Like f. ε, but the ends not recurved, and the striae not tightening at the ends. Inner nodules visible — robust. Striae coarse, luminating. Fig. 2: 78.

E. Grun. f. η. 40—50×8; str. 14. Belonging to the cycle of f. β, but has been separated from this one because of the three flat dents

on dorsal margin, which make this form constitute a transition to *E. polyglyphis*. Fig. 2: 79.

E. Grun. f. ♀. 40—80×4—4 $^1/_2$; str. 10 $^1/_2$—14. Slightly arcued; margins quite parallel. Ends not detached, rounded, at times feebly recurved. Inner nodules scarcely or not visible. Striae coarse, somewhat diffuse. Valve robust, with margins roundish. — An allied form is noted from Cameroon; dim 38×4 $^1/_2$, str. 15, inner nodules well visible, margins strongly rounded. Fig. 2: 80.

E. volvo n. sp. Syn. *E. elegans* Östr. according to Hust. 1932 fig. 752! Strongly arcuate (rise 1: 3—5), margins quite parallel. Ends rounded, not detached. End nodules not particularly coarse, inner nodules almost invisible. Striae sharp and regular. Valve rather robust, with margins roundish. Fig. 2: 81.

E. pseudo-parallela n. sp. 100—120×10; str. 8—9. A robust, lineal, slightly arcued type with roundish margins. Ventral margin generally distinctly in three parts, the distances outside the inner nodules somewhat convex. Ends rounded, seldom vaguely recurved. End nodules subjacent, coarse, inner nodules well visible, and generally in a distinct impression in the ventral margin. The raphe strong, striae coarse, parallel, at times however at right angle to the ventral margin. Side-line well visible, at least at the ends. Fig. 2: 82.

E. pseudo-p. f. α. 35—120×4—7; str. 10—14. Narrower and with denser striation than the main form. Fig. 2: 83.

E. pseudo-p. f. β. 20×3; str. 20. A denser striated minor form. Fig. 2: 84.

E. pseudo-p. f. γ. 100—110×4; str. 15—18. Denser striated; only most slender forms noted. Fig. 2: 85.

E. pseudo-p. f. δ. 75—85×8—9; str. 10. Valve quite flat, but growing roundish at the ends. Ends not as robust as in the main form, and slightly produced. Side-line and inner nodules visible. A few dorsal striae. — A type more than usually dubitable. The distinct inner nodules show with sufficient clearness that it has nothing to do with *Subtile's E. parallela,* but the more delicate end nodules, not to speak of the dorsal striae, are equally strangers to the *Grunowiae*. I have placed it here because in fact I do not know where else to place it. Fig. 2: 86.

E. fallax A. Cl. f. α. Syn. *E. Nymanniana* A. Cl.-E. 1895, Fontell 1917. 35—50×3 $^1/_2$—6 $^1/_2$; str. 18—22. A direct continuation of the main type, with denser striae. Ventral line straight. Besides the typical oblique cornuta-ends you meet also with ends all but perpen-

dicularly cut, announcing the denticulata-type. Heteromorphism is even noted, a symptom of lability of forms. Inner nodules generally well developed. Fig. 2: 87.

E. lapponica A. Cl. f. α. c:a 150×9; str. 16 (19). As a form of *E. lapponica* I must consider a curious fragment, found in a subfossil deposit at Örträsk. It differs from lapponica by the ends not detached, quite semi-circular, the raphe running longer on the valvular side, and the hyaline area outward limited by a wreath of short striae, leaving the apex entirely smooth. Inner nodules are not visible. The possibility remains, that it is about a sporangial form; though it is imperfectly known, I did not wish to pass it by. Fig. 2: 88.

E. polyglyphis Gr. f. α. 47×8; str. 15. Strongly arcued, ventral margin with a central limited incision. Fig. 2: 89.

E. scarda n. sp. 85×23; str. 9. Dorsal margin strongly arcued, together with the ends forming the half of an ellips. Ventral line straight, towards the ends abruptly rising, in the same manner as *E. robusta*. Dorsal margin divided in (10) dentations. The raphe strong, curved inward the centre of apex. Inner nodules uncommonly robust, forming together a rather high costa (cfr *E. tanensis*). Striae coarse, regular, at right angle to the ventral margin. No side-line visible. — Reminds to a certain degree of *E. serrata* Hust. in A. S. Atlas T. 274: 1—2, a fossil form from New Yersey. Fig. 3: 90.

E. polydentula (Brun.) emend. 10—30×3—4; str. 15—18. Arcued, margins parallel. The dorsal line divided in generally 4 undulations or dentations, at times both forms merging into one another. Ends about $^2/_3$ of the height of valve, rounded capitate (bilaterally). End nodules at the lower side of caput; inner nodules not distinct. Striae at right angle to the apical axis.

E. polyd. f. *perminuta* Gr. *monodon* (Mayer). 15×3; str. 15. Syn. *E. tridentula* var. *perminuta* f. *monodon* A. Mayer 1918. — Dorsal line not undulated.

E. polyd. f. α. 23×4; str. 18. Dorsal line crenated, ventral line with the middle part impressed, straight, and outside this heels, corresponding to the utmost undulation. Fig. 3: 91.

E. polyd. f. β. 18—22×4; str. 18. Ends not capitate, rounded. Dorsal margin undulated, ventral margin with robust heels. Fig. 3: 92.

E. perpusilla (Gr.) emend. (V. H. Syn. T. XXXIV: 31) 1—17× $2\ ^1/_2$—3; str. 19—23. The main type, agreeing with the figure cited is all but straight or slightly arcued; dorsal margin reversed dentated,

ends protracted capitate of barely half the height of valve. Ventral margin with pointed heels; end nodules very delicate, subjacent.

E. perp. f. *tridentata* (A. Mayer). Syn. *E. tridentula* Ehr. var. *perpusilla* Gr. f. *tridentata* Mayer 1918. $16\ ^1/_2 \times 2\ ^1/_2$; str. 21. Dorsal margin generally with one median point and a flat undulation on either side. Ends as the main type. Ventral margin with median part straight, impressed, the outer parts strongly convex (rounded heels). The inner nodules are coupled to a well visible embossment along the median part of ventral line.

E. perp. f. α. $15 \times 3\ ^1/_2$; str. 20. Dorsal margin strongly arcued, reversed dentated; ends rounded, not protracted, bent down in continuation of the dorsum. Ventral line strongly concave with projected, pointed heels. Striae very delicate. Fig. 3: 93.

E. perp. f. β. 22×4; str. 23. Straight; dorsal margin divided in three rounded undulations; ends rounded capitate. Ventral margin with the median part straight, impressed, the outer parts rounded, convex. Striae radiating. Fig. 3: 94.

E. perp. f. *simplex* (Mayer). Syn. *E. tridentula* var. *perpusilla Gr.* f. *simplex* Mayer 1918. 9—17×2—3; str. 19—20. Dorsal margin strongly arcued, even. Ventral margin slightly concave or divided in two convex parts, without heels. — KRASSKE's *E. microcephala* (1932, Hust. 1932 fig. 756 a—l) is identical with this form.

E. tridentula (Ehr. emend). — This species does not in its entity correspond to the figures given by GRUNOW in V. H. Syn. T. XXXIV: 29—31, which belong to the two precedent species. — $10—22 \times 2\ ^1/_2—4\ ^1/_2$; str. 16—19. Gently arcued, with margins almost parallel. Dorsal line undulating with 2—4 rather flat waves. Ends rounded, dorsally softly detached. All the ventral line an even and feeble arc. End nodules subjacent. Striae fine, regular, at right angle to the ventral line.

E. trid. f. α. $10—20 \times 2\ ^1/_2—3$; str. 20—24. Strongly arcued; the dorsal line divided in 2—3 ridges, ends unusually extended, with the same height as the valve, dorsally capitate, rounded or square cut. The ventral margin an even arc. Nodules in the lower edge of the ends. Striae at right angle to the ventral margin. Fig. 3: 95.

E. trid. f. β. 16×3; str. 25—30. Like f. α, but with denser striation.

E. trid. f. γ. 19×3; str. 31—37. Like the preceding, but with denser striation.

E. trid. f. δ. 18×3; str. 25—30. Like the main form of the species, but with denser striation. In the only specimen found, the dorsal

margin was divided in two very pointed dents in centre, and one flat undulation on either side. Fig. 3: 96.

E. trid. f. ε. 18—20×3—4; str. 16—19. Straight; dorsal margin varying from smooth, parallel to the ventral line, to divided into flattened crenation with the median part depressed. Ends rounded, feebly dorsally detached. Nodules subjacent. Fig. 3: 97.

E. trid. f. *dentata* (Mayer, emend.). Syn. *E. tridentula* var. *perminuta* Gr. f. *quadridentata* Mayer 1918. Like the main form, but the dorsal margin dentated.

E. tinea n. sp. 17—18×3½—4; str. 30+. Dorsal margin a flattened arc, ventral margin straight. Ends rounded, dorsally inflated, inconsiderably narrower than the median part. End nodules subjacent — withdrawn. Inner nodules well visible. Striae extremely fine, sharp, radiating at the ends. Fig. 3: 98.

E. Tassii n. sp. 9—13×2½—3.7; str. 17—21. Dorsal line strongly arcued, in the main form divided in two strong waves; ends rounded, little produced. Ventral margin divided in two convex parts, outward sharply limited. Striae sharp, radiating from centre, aequidistant. End nodules on the lower margin of apex. Fig. 3: 99.

E. Tassii f. α. 10×3 ½; str. 17. Dorsal margin divided in three dents; ends not detached on ventral side. Striae distinctly curved. Fig. 3: 100.

E. Tassii f. β. 9×3; str. 22. Dorsal margin very high, divided in three flat reversed dentations. Ends strongly tapering, feebly detached only from dorsal side. Ventral margin an even arc. Fig. 3: 101.

E. Tassii f. γ. 12½×3½; str. 19. Dorsum roof-shaped with very strong shoulders; ends bilaterally capitate, down-bent; ventral margin bracket-shaped. Fig. 3: 102.

E. Tassii f. δ. 10×2.7; str. 26. Dorsum roof-shaped without shoulders; ends bilaterally capitate. Ventral margin evenly divided by two convex undulations. Striae not radiating. Fig. 3: 103.

E. fugitiva n. sp. 8—15×2—2 ½; str. uncertain, c:a 22—30. Ventral margin straight, ends more or less dorsally capitate; dorsal margin varying, strongly arcued — roof — or bracket-like. The end nodules appearing as luminous points in the centre of caput. Striae extremely delicate, at times quite invisible. — The forms brought together in this species probably ought to be divised on several unities, but the minceness of the objects, the difficulty in producing a correct and true image have made it impossible for me to attain sufficient certainty for deciding matters. Fig. 3: 104.

E. trinacria (Krasske 1929, emend.). 19—22×2½—3; str. 18—22. Imperceptibly arcued — straight. Dorsal line flattened bracket-shaped, ends obtusely tapering. End nodules on the lower side of apex. Striae strictly parallel, extremely thin. No inner nodules.

E. trin. f. α. Str. 30. Like the main type, but densely striated. The main type corresponds rather well as to outline and striation with certain types reproduced by HUSTEDT (1932) as *E. trinacria* var. *undulata,* but on the contrary not with the original diagnosis of KRASSKE (1929) fig. 1 a—d. This one seems to be not quite irreproachable, since the statements about the length vary between 4 and 40 μ. The figures do not deal with other lengths than between 7 and 11 μ (besides that no attention has been devoted to the nodules, hence I must consider the figures incomplete). Out of my material I daresay the extremely small and at the same time densely striated forms do not vary but most inconsiderably as to details in outline; at all events the variations are so insignificant, — apart from the length in some extent, — that they hardly can be rendered by a drawing apparatus, still less by the camera. Such a latitude of variation in length must prove, I think, that several types have been brought together. For that reason I have not taken into consideration KRASSKE's diagnosis, but described the species only from the Örträsk material. KRASSKE's shortest *trinacria*-forms may be found again in another place further on.

E. hyperborea n. sp. 200—250×11; str. 13—15. Arcued (1: 14) with quite parallel margins, which are strongly rounded. Ends not or imperceptibly recurved, of the same height as the valve. The raphe strong, running uncommonly long in the valvular side; it reaches with an arching a little withdrawn from the apex past the apical axis. End nodule area rather small, regularly following the raphe. Inner nodules not visible. Side-line uncommonly high, beginning at the centre of the ends and running in an even arc not nearer the ventral line than 2—3 μ. Striae fine, sharp, regular, perpendicular to the side-line. — By the first view of this curious form I thought it a sporangial form, equally to FONTELL's (1917) *E. Astridae,* but the narrower scrutiny showed that *E. hyperborea* really is a good species, compromising in a very happy manner the transition from *E. Grunowi* to *E. triodon,* both as to raphe, striation and valve. Fig. 3: 105.

E. hyperb. f. *Astridae* (Fontell). Syn. *E. Astridae* Font. 1917. — 90—130×14—20; str. 16—17. More strongly arched; ends somewhat recurved, all but of the same height as the valve. Dorsal line with three very flattened undulations, sometimes well-nigh invisible.

The raphe high and long in valvular plane. End nodule area very much irregular; side-line like that of the main type. Striae almost regular, distinctly lined. — This type map be considered standing nearer to *E. triodon* than to *E. hyperborea,* but as it must be apprehended as a consecutive form of the last named, as well as a predecessor to the former, I have thought it more properly out of a systematical point of view to place it beneath *E. hyperborea.*

E. triodon Ehr. f. *minuta.* 23—30×12—14; str. 17—20. A small and relatively high form with dorsal ridges feebly developed. The distance between the two inner nodules very short. Fig. 3: 106.

E. triod. f. α. 50—55×16—17; str. 19, thinner at the ends. — Valve geniculate in all but a right angle; dorsal ridges feebler.

E. exigua-gracilis (W. Sm. emend.) f. α. 35—65×4—5. Ventral margin with a median pointed embossment. Fig. 3: 107.

E. exigua-denticulata (Bréb. emend.). f. α. 30—40×4; str. 21—26. Quite accordant with the main type, but with denser striation.

E. attenuata A. Cl.-E. f. *tokiensis* A. Cl.-E. in man. 15—50×4—4$^1/_2$; str. 17—21. Dorsal margin strongly arcued, ventral margin gently concave. Ends short, rather acute, bent upwards cornuta-like, rounded on ventral side. Inner nodules generally well visible. Striae feebly radiating from centre. Fig. 3: 108.

E. att. f. α. 40—50×3$^1/_2$; str. 17—21. Gently arcued with ends softly bent upwards. Evenly tapering from the middle. End nodules subjacent, somewhat withdrawn from ends, dot-like. Raphe 6—6$^1/_2$ μ, to the whole extent well visible from valvular side. Striae regular, more delicate than in preceding form. — Possibly this form ought to constitute a species of its own, with regard to the peculiar structure of the raphe, but the material at hand was rather scanty to form a sufficiently clear comprehension of its limits, and besides it seems well to join the main type as a tropical, somewhat impaired variable. On the other side it forms an incontrovertible transitional form to the following species. Fig. 3: 109.

E. graphica n. sp. 25—30×2—2$^1/_2$; str. estim. c:a 40. Dorsal margin very feebly arcued in an even arc on to the apices; ventral margin quite straight. Ends obtusely rounded, not detached. The raphe 5 μ, to its whole length well visible, and in conformity to the end nodules strongly refractive; the latter seem to occupy the whole central part of apices. Striae sharp, perpendicular to the ventral margin.

This most curious form has been placed among the Grunowiae

on account of the strongly developed raphe and end nodules. Surely you may connect it with the preceding *E. attenuata* f. α, though the end nodules are essentially different, but the step between the main forms is evidently very large. Fig. 3: 110.

E. Nymanniana (Gr. emend.). V. H. Syn. T. XXXIV: 8, 10. — 26—40×3—5; str. 15—19. Dorsal margin an even slender arc; ventral margin inconsiderably more feebly arched. Ends capitate, hammer-like with the outside convex, and to the greater part extended towards the dorsal side; their length axis converge downwards in rather varying angles. The end nodules occupy the ventral part of the hammer, rather coarse. Inner nodules delicate, at times invisible. Striae perpendicular to the apical axis, strictly parallel on to or past the end nodules, somewhat diffuse. Fig. 3: 111 (central type).

E. Nym. f. α. 17—25×3—5; str. 15—19. Shorter forms, less arcued. Ends not inflated towards ventral side. Fig. 3: 112.

E. Nym. f. β. 15—25×3$^1/_2$—4$^1/_2$; str. 20—24. Like f. α, but with denser striation.

E. Nym. f. γ. 25—45×3; str. 20—25. Like the main type, but with denser striation. End nodules remarkably coarse.

E. Nym. f. δ. 40—45×3; str. 19—20. Margins well-nigh parallel. Feebly arcued. Ends rounded capitate, inconsiderably inflated towards ventral side. The valve more rounded than other forms hereto appertaining. Fig. 3: 113.

Tribe V. *Sudeticae.*

E. gratella n. sp. 20—50×4—7; str. 8—12. Margins strongly rounded. Ventral line fairly straight, at times somewhat bent down outside the inner nodules. Dorsal margin either straight with rather accentuated shoulders above inner nodules, or a very flat arc with more or less levelled shoulders. Ends rounded, of about half of the height of valve. End nodules end-placed, subjacent, rather small. Inner nodules strong. Striae sharp, denser and radiating towards ends. Fig. 3: 114.

E. grat. f. α. 30—40×9; str. 6—6$^1/_2$. A relatively high form, with dorsal margin arcued and ends rather indistinctly detached. Inner nodules feebler than in the main form. Striae remarkably coarse, distinctly lined. The valve uncommonly strongly rounded. Fig. 3: 115.

E. grat. f. β. 15—35×4$^1/_2$—7; str. 11—15. Margins strongly rounded. Dorsal line generally divided in three parts like the main

type, but more elevated. Shoulders at times all but effaced, so that the dorsal line softly merges into the ends, feebly detached. Inner nodules strong. The length of the raphes only varying between 6 and 8 μ, but the valves between 15 and 35, they lie in the larger specimens below the shoulders, but almost meet in the shorter forms. — This form varies greatly. Fig. 3: 116.

E. sudetica O. Müll. f. α. 15—20×4; str. 12—13. Dorsal margin arcued, ends dorsally abruptly detached, rounded. End nodules somewhat withdrawn; striae radiating from centre. Fig. 3: 117.

E. sudetica f. β. 35—40×4—4½; str. 11—14. A direct continuation of *E. sudet. f. revoluta* from which it is separated only by its denser striae.

E. sudet. f. *emycephala* A. Cl.-E. 1938 in man. 50×5; str. 8—9. Dorsal margin a flattened arc. Ends dorsally detached, of about half of the height of valve, arched in line with the straight ventral margin. End nodules below the narrow neck. Striae regular, feebly radiating towards ends. Fig. 3: 118.

E. sudet. f. *cameroonensis.* 20—45×4½—6; str. 8—11. Ventral line straight, dorsal line a flattened arc, by the longer forms with median part straight, by the shortest an even, stronger arc. Distinct shoulders generally not at hand. Ends rather narrow, rounded, not detached. End nodules somewhat, but plainly, withdrawn, small. Inner nodules well visible. Striae fine, sharp, irregular, denser and feebly radiating towards ends. Margins of the valve strongly rounded. Length of raphe 6—8½ μ. — This form has been advanced as a transition between *E. gratella* and *sudetica.* It is separated from *E. faba* by its end nodules being less withdrawn. At first I referred it to *E. gratella,* the more elongated froms having indubitably a great resemblance to the typical form of that one, but with regard to the shape and placing of the end nodules I have thought it more suitable to grasp it as a form of *sudetica.* Fig. 3: 119.

E. faba (Ehr. Gr. emend). 14—18×6—10; str. 10—14. Strongly varying in outlines. The typical faba-form has the dorsal margin strongly arcued in a smooth arc, ventral line straight or feebly concave, ends broad, obtusely rounded. At times, especially in more elongated specimens, it merges to a clear parallela-form, though by other characteristics easily discerned as a faba. End nodules strong, distinctly withdrawn from apices; inner nodules distinct. The raphe 8—9 μ. Striae sharp, regular, more or less radiating from centre, and generally, but not always, becoming denser at the ends. Rarely

solitary dorsal striae. Side-line not visible. — A rather striking type, found the world over, has margins exactly parallel and ends semicircular.

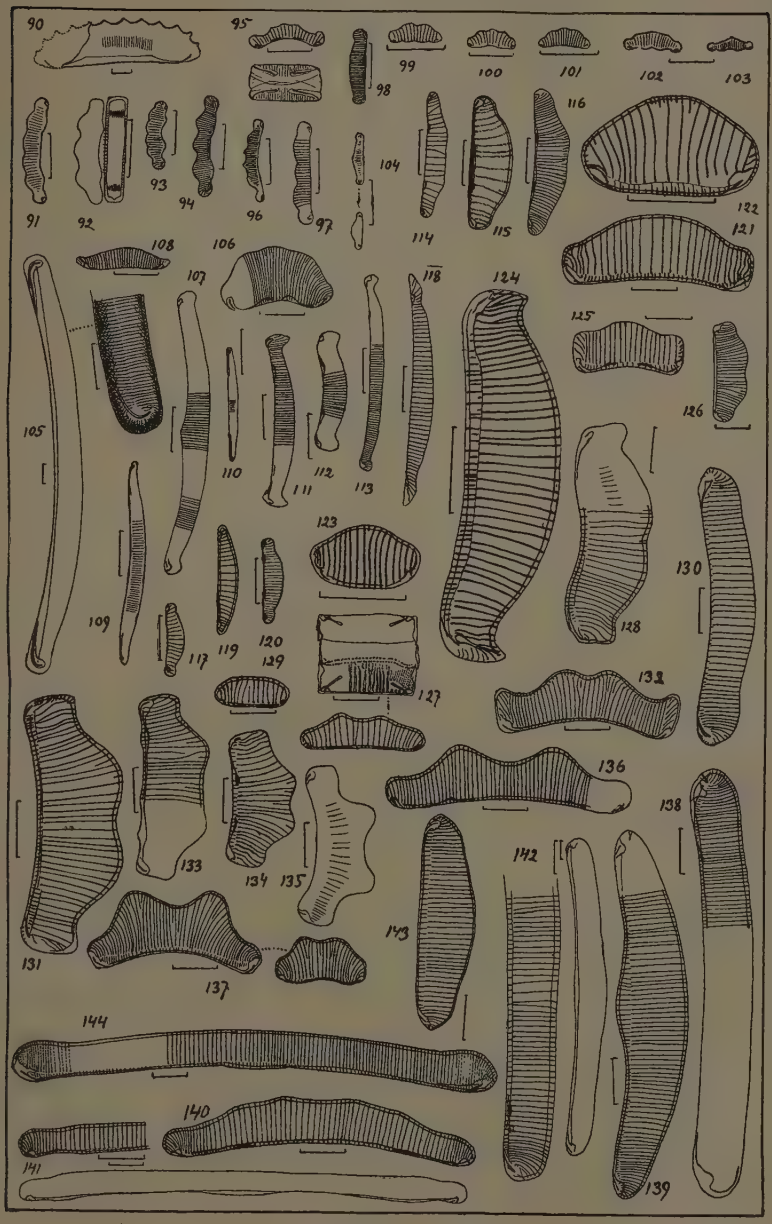
E. faba f. α. Str. 15—19. This form has been set forth solely on account of its denser striation. Varies as to outline like the main type.

E. faba f. β. 15—60×4—5; str. 11—15. Narrow forms with varying dorsal margins. Ventral line generally straight. Merges into *E. veneris*.

E. veneris (Kz. emend.). 15—50×3 $^1/_2$—6; str. 16—20. A direct continuation of *E. faba* f. β. The typical main form shows a very much flattened circle-segment, ventral margin straight; acute, at times somewhat declinate ends. The margins roundish. End nodules strongly withdrawn; length of raphe $5^1/_2$—7 μ. Inner nodules well visible. Striae fine, sharp, towards ends radiating and thickening.

E. ven. f. α. 15—25×4—4$^1/_2$; str. 15—17. This form has only with some uncertainty been placed in this group. Dorsal line and ends agree with those in *E. pectinalis*, ventral line straight, but furnished with little embossments at the inner nodules, which are more strongly developed than by the other forms of the species. End nodules strong, subjacent, but not as withdrawn as in *E. veneris*. Striae fine, regular, feebly radiating and somewhat tightening at the ends. Fig. 3: 120.

Fig. 3. 90 *E. scarda*, Örträsk. 91 *E. polydentula* f. α, Örtr. 92 *E. polyd.* f. β, Örtr. 93 *E. perpusilla* f. α, Örtr. 94 *E. perp.* f. β, Örtr. 95 *E. tridentula*, f. α, Örtr. 96 *E. trident.* f. δ, Örtr. 97 *E. trident* f. ε, Örtr. 98 *E. tinea*, Örtr. 99 *E. Tassii*, Örtr. 100 *E. Tassii* f. α, Örtr. 101 *E. Tassii* f. β, Örtr. 102 *E. Tassii* f. γ, Örtr. 103 *E. Tassi* f. δ, Örtr. 104 *E. fugitiva*, Örtr. 105 *E. hyperborea*, Örtr. 106 *E. triodon* f. *minuta*, Örtr. 107 *E. exigua-gracilis* f. α, Örtr. 108 *E. attenuata* f. *tokiensis* A. Cl.-E., Örtr. 109 *E. atten.* f. α, Bengal. 110 *E. graphica*, Örträsk. 111 *E. Nymanniana* Gr, Örtr. 112 *E. Nym.* f. α, Cameroon. 113 *E. Nym.* f. δ, Örträsk. 114 *E. gratella*, Örtr. 115 *E. grat.* f. α, Lake Vättern. 116 *E. grat.* f. β, Maine. 117 *E. sudetica* f. α, Örträsk. 118 E. sud. f. *emycephala* A. Cl.-E., Lule lappmark. 119 *E. sud.* f. *cameroonensis*, Cameroon. 120 *E. veneris* f. α, Savoy. 121 *E. praerupta-monos*, Siberia. 122 *E. pr.-mon.* f. α, Örträsk. 123 *E. pr.-mon.* f. β, Örtr. 124 *E. pr.-mon.* f. *cornuta*, Örtr. 125 *E. pr.-mon.* f. *polaris*, Jenissej. 126 *E. pr.-mon.* f. *undata*, Örträsk. 127 *E. pr.-mon.* f. γ, Isle of Lewis. 128 *E. pr.-mon.* f. δ, Örträsk. 129 *E. ovata*, Isle of Lewis. 130 *E. submonodon* f. *depressa*, Massachusetts. 131 *E. Sarek*, Örträsk. 132 *E. Sarek* f. *bigibba*, Jotunheim. 133 *E. Sarek* f. β, Örträsk. 134 *E. Sarek* f. γ, Örtr. 135 *E. Sarek* f. δ, Spitzbergen. 136 *E. Sarek* f. ε, Spitzb. 137 *E. Sarek* f. ϑ, Spitzb. 138 *E. major* f. *parallela*, Finnish Lappm. 139 *E. major* f. β, Småland. 140 *E. major* f. δ, Smål. 141 *E. major* f. ε, Bengal. 142 *E. major* f. ζ, La Plata. 143 *E. major* f. *compacta*, Maine. 144 *E. major* f. *plectrum*, Maine.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Tribe VI. *Praeruptae.*

Group. 1. *Praeruptae-monos.*

E. praerupta-monos (Ehr. emend.). 19—112×7—21; str. 5—9. Valve flattened with strongly rounded margins. The main type has a dorsal margin strongly arcued, shoulders imperceptible, ends more or less distinctly detached from dorsal side, rounded — square-cut. Ventral margin straight — feebly concave; at times the end parties are straight and the middlemost part either impressed straight or concave. The raphe coarse but uncomplicated; the part on valvular side is low, lying near the outline. Striae broad, strong, plainly lined, heterodistant, getting denser towards ends. Dorsal striae are at hand normally. Side-line well marked. Fig. 3: 121 (central type).

E. praer.-m. f. α. 18—23×12. Extremely short form; dorsal margin forming a truncated roof-line; ends not detached, rounded. Ventral line straight — convex. Fig. 3: 122.

E. praer.-m. f. β. 20×11; str. 9. Presumably a reduction form. Valve forming a lying oval, somewhat irregular. Differs from the preceding i. a. by the lacking or invisible side-line. Fig. 3: 123.

E. praer.-m. f. *cornuta.* Differs from the main type only by the ends, which are axially depressed, rounded at the ventral side, extended in a curved tip at the dorsal side. Fig. 3: 124.

E. praer.-m. f. *polaris.* 25—35×10—12 $^1/_2$; str. (6)8—9. Ashort and high type. The median part of dorsal margin a strong arc, the ends obtusely produced dorsally, feebly rounded — square-cut, the angle to the ventral line rather sharp. Ventral margin feebly concave. Striae strikingly parallel on to the end nodules. Side-line well visible. Valve quite flattened with scarcely perceivable marginal roundings. Fig. 3: 125.

E. praer.-m. f. *undata.* 25—35×8—10; str. 8—9. Dorsal margin with a median flattened depression. Ends high, rather square; striae distinctly radiating. Side-line visible. — This type merges without any other altering in outline or size into the densely striated forms. Fig. 3: 126.

E. praer.-m. f. γ. 15—30×5—8; str. 8—12. Dorsal margin divided in two ridges; ends square, rounded, ventral margin straight or imperceptibly impressed. Inner nodules generally visible. Fig. 3: 127.

E. praer.-m. f. δ. 40—60×15; str. 7 (—11 at the ends). Dorsal line strongly arcued, divided in two parts by a shallow depression. Ends cornuta-like, square-cut — feebly concave. Ventral margin a

double wave-line. — A north american form differs from this lapponian by the ends not being extended dorsally. Fig. 3: 128.

E. ovata n. sp. 15—20×6—7; str. 10. The outline forming an almost regular oval. Side-line visible. Striae sharp, irregular, parallel. End nodules very small. Valve robust. Fig. 3: 129.

E. ovata f. α. 9×3.6; str. 19. Identical with the main type, but denser striated. Fig. 5: 191.

E. submonodon Hust. f. *depressa.* 50—80×10—12; str. 7. Slightly arcued, margins parallel, ends feebly dorsally detached, rounded — somewhat acuminated. The raphe like that of the main type. Side line visible; striae fine, sharp, parallel, denser towards ends. The valve quite flat, shortly rounded at the margins. Fig. 3: 130.

E. Sarek n. sp. Syn. *E. suecica* (Hust. 1924 T. 19 fig. 3, 4). 40—55×14—17; str. 7—9. Dorsal margin very high, divided by two ridges which are separated by an impression of c:a 2 μ. Ends strongly detached dorsally, of somewhat more than half the height of the ridges, their outside edge convex — almost straight. Ventral margin a smooth concave arc. The raphe in valvular side all but invisible, on account of the strong vaulting of the valve. Striae coarse, irregular; short dorsal striae. Side-line visible. Fig. 3: 131.

E. Sar. f. *pumila* (Gr.). Syn. *E. bigibba* var. *pumila* Gr. (V. H. Syn. T. XXXIV: 27). 19—28×7—10; str. 10—14. — A diminutive form of the main type.

E. Sar. f. α. (Hust. 1932 fig. 746=»*E. suecica*» A. Cl.) 30—60×20. Differs from the main type by more pointed and higher dorsal ridges (the impression 4—5 μ), ventral line almost straight; side-line very low, rising in an arch to the end of the raphe. — Evidently a local form; as the Örträsk type seemingly has the greater distribution, and as to its outlines appears somewhat less outrées, I have chosen it for the main type.

E. Sar. f. *papilio* (Gr.). 20—45×13—20; str. 7—10. An exaggerated form of *E. Sarek.* The two dorsal ridges high and steep, with outsides at times almost perpendicular to the side-line. Dorsal impression 4—5 μ. Ends about rectangular, not or imperceptibly extended dorsally. Ventral margin strongly concave. Side-line well visible. Striae more irregular than in the main form, with dorsal striae numerous, often reaching half-way down.

E. Sar. f. *bigibba* (Kz.). Syn. *E. bigibba* Kz. (V. H. Syn. T. XXXIV: 26). 25—45×8—12; str. 9—11. Corresponds well to the main type,

but the dorsum essentially lower. Ends about $^5/_6$ of the height of valve. Fig. 3: 132.

E. Sar. f. β. 40×14; str. 10. Dorsal margin with two low knolls, divided by a straight line. Ventral margin straight, with heels visible. Ends square, not inflated. Striae and side-line as the main form. Fig. 3: 133.

E. Sar. f. γ. 18—32×8—14; str. 8—10. Short and high forms. Dorsal margin divided in two approximate ridges, rounded or rather pointed. Ends square, not inflated. Side-line quite straight. Inner nodules more conspicuous than common. Fig. 3: 134.

E. Sar. f. δ. 30—40×13—14; str. 7—10. Dorsal ridges strong, ends extended, square. Ventral margin strongly arcued. Fig. 3: 135.

E. Sar. f. ε. 25—55×10—14; str. 10—12. A slender form with dorsal ridges more acuminate. Ends strongly extended, square — rounded. Side-line visible only at the ends. Dorsal striae reduced or lacking. Fig. 3: 136.

E. Sar. f. ϑ. 20—40×10—15; str. 11—14. A denser striated variation of the main type. — Though transgressing the species limits as to frequency of striae, this form is so closely conneted with the cycle of *E. Sarek,* that I hardly can adopt it as a species of its own. One marks that this form is by far more movable within its given type than the main form. Fig. 3: 137.

E. major (W. Sm. Rbh. emend.). MAYER 1918 p. 109 fig. II: 9. 28—160×6—9; str. 10—12. Feebly arcued; dorsal margin slightly tapering from centre. Ends somewhat inflated dorsally, more or less obliquely cut off. Ventral margin scarcely rising at the ends. The raphe almost invisible in valvular view. Striae strong, punctated, not quite regular, perpendicular to the ventral margin.

E. major f. α. 90—160×10—14; str. 8—11, scarcely thickening towards ends. — The northern form of *E. major.* Valve strongly rounded. The ends generally built as fusiform thickenings, almost quite symmetrical to the apical axis, rounded-acuminated. Of the raphe very little is to be seen in valvular view. Striae somewhat irregular, very coarse, punctated, perpendicular to the ventral margin; the pore-line next to the side-line remarkably coarse. Side-line rather high, in straight line from the end of the raphe. End nodule area all but lacking. — Most varying as to the shape more or less fusiform of the ends and the rounding of margins, from almost flat unto halfelliptical in section. — From Oregon is noted one quite linear type with ends stronger inflated, thus very much reminding of *E. gracilis.*

E. maj. f. β. 40—90×9—16; str. 9—11. Dorsal margin a smooth arc, ends not detached, rounded. Ventral margin less arcued, provided with a broad embossment. Side-line high, in all its length parallel to the dorsal line. Fig. 3: 139.

Ex. maj. f. γ. Syn. *E. major* var. *bidens* Greg. (A. Cl.-E. 1934 p. 21 fig. 14). 103×12; str. 9—12. Margins almost parallel; dorsal line with a short depression. Ends dorsally detached, rounded — slightly acuminated. — A parallel form to the f. *bidens* W. Sm., from which it has been separated by the same causes as f. α from the main type.

E. maj. f. *parallela.* 70—120×10—12; str. 11—12. Corresponds as to the outlines completely with *E. parallela.* Dorsal margin often showing a feeble median depression like *E. jemtlandica.* Ends circularly rounded, margins broadly rounded. End nodules coarse and somewhat withdrawn from apices; the raphe well visible in valvular view. — Valve robust. Differs from f. linearis by the margins running strictly parallel, and ends not at all detached. — A possibility is at hand that the E. parallela in Grunow 1884 is identical with this form, but I have not been able to decide the matter with certainty. Fig. 3: 138.

E. maj. f. δ. 45—75×7 $^1/_2$—10; str. 9—10. Dorsal margin undulated (2—4 ridges). Inner nodules feeble but visible. — Reminds very much of a *pectinalis,* from which it is however separated easily by the inner nodules and stronger end nodules, for one thing. Fig. 3: 140.

E. maj. f. ε. 120—140×6—7; str. 10. Straight, almost linear. The side-line strictly parallel to dorsal margin; ventral margin inflated in the median part and before the ends, which thus get detached from both margins. Valve strongly arcued, with coarse striae. Inner nodules not visible. Fig. 3: 141.

E. maj. f. ζ. 160—220×12—15; str. 6—8. Valve flattened, rather broadly rounded, slightly arcued, margins parallel. Median part with a broad inflation. Ends not at all or feebly detached dorsally. Striae narrow, very sharp, plainly lined, heterodistant. Raphe well visible in valvular view, as well as the inner nodules. Side-line distinct. Fig. 3: 142.

E. maj. f. *plectrum.* 60—150×6 $^1/_2$—11; str. 7—10. Slightly arcued, margins well-nigh parallel. The median part with a shortly limited inflation, rounded or pointed, uni- or bilateral. The ends tending towards axial symmetri, more or less distinctly acuminate. End nodule area rather large, at times irregularly extended towards the side-line. End nodules strong, inner nodules generally not visible. The raphe

distinct in valvular view. Side-line well visible, at least at the inflations. Striae coarse, very much heterodistant, plainly lineated, at times increasing in frequency at the ends rather abruptly. Valve roundish, coarse. — This form makes a most remarkable parallel to *E. sumatrana* (Hust); by its fusiform ends, the robust valvular raphe etc. it is separated from the latter. Fig. 3: 144.

E. maj. f. *excelsa.* 75—150×5 $^1/_2$—11; str. 11—15. Slightly arcued, margins parallel though inconsiderably narrowing dorsally above inner nodules. Ends obliquely, chiefly on dorsal side inflated. End nodules very coarse, the raphe well visible, as well as the inner nodules. Striae coarse, rather regular, strictly parallel to themselves. Side-line visible only at the ends. — A very robust form, conspicuous by the unusually vigorous ends. Fig. 4: 145.

E. maj. f. *indica* (Gr.). Syn. *E. indica* Gr. 1865 p. 5 fig. I: 7, a—b. 30—110×5 $^1/_2$—15; str. 8—12. Dorsal margin a flattened arc, at times with the median part straight or with a very gentle depression; shoulders generally smoothed out. Ends dorsally inflated, obliquely cut off. Ventral margin straight, in the more elongated forms slightly concave. Valve coarse, roundish. End nodules plainly subjacent, even at times a little withdrawn. Inner nodules more or less distinctly visible. The raphe-end well visible in valvular view. Striae coarse, irregular.

The only reason to maintain this form as a species of its own is the end nodules, which are at times more subjacent than is common in the major cycle. On the other side f. indica merges without any gap in the short *major*-forms, besides which there is a rather great variation as to the nodules within the form, even heteromorphism. — Grunow has found a f. *ventralis* at Banka.

E. maj. f. *compacta.* 25—50×10—13; str. 8—13. Ventral margin straight, dorsal margin with a median inflation, which in the short specimens occupy the whole margin. Ends rounded — obtusely acuminated, not quite symmetrical to the apical axis. Side-line straight, high. Striae strictly parallel to one another. Fig. 3: 143.

E. formica f. α. 35—40×11—12; str. 9 $^1/_2$. Dorsal margin imperceptibly inflated in the median part, ends rounded, ventral margin strongly inflated. Side-line quite straight between the small end nodules. Pores in the striae 27. Fig. 4: 146.

E. form. f. β. 25—30×9 $^1/_2$—12; str. 9—11. Dorsal margin with a distinct though very low median inflation. Ends rounded; ventral margin straight or imperceptibly concave. Side-line rather high. Fig. 4: 147.

E. form. f. *stricta.* 70—80×8; str. 9 $^1/_2$. Almost straight; ends not detached or inflated, strictly symmetrically acuminated. Ventral margin with a slight median inflation. Fig. 4: 148.

E. nodosa n. sp. 35—50×5—5 $^1/_2$; str. 14—17. Margins quite or practically parallel; ends as in *E. formica genuina.* No inner nodules visible. Side-line not visible. Fig. 4: 149.

E. rostrata n. sp. 45—95×15—20; str. 9. Dorsal line strongly arcued, but softly tapering to the ends. These are rounded, in the elongated forms extended, of about half the height of the valve. Ventral line straight. End nodules strong, merging with the very apex. The raphe generally forms a crooked line well visible in valvular view. No inner nodules visible. Side-line straight, rather high. Striae strictly perpendicular to the ventral line, remarkably coarse, heterodistant. The valve quite flat, with strongly rounded margins. Fig. 4: 150.

E. arcus Ehr. f. *concinna.* 40—50×6—8; str. 10—12. Margins parallel; dorsal line and ends of the same height. Ends rounded, softly inflated dorsally. Inner nodules visible. Valve robust, with a strong marginal rounding. — Corresponds rather well with MEISTER's (1912) *E. arcus* var. *genuina* T. XI: 11. Fig. 4: 151.

E. arcus f. *sphaerocephala.* 70—110×8 $^1/_2$—11; str. 9—12. Slightly arcued; margins strictly parallel, dorsal line with or without shoulders feebly marked. Ends smoothly detached on the dorsal side, circularly rounded, their height about $^3/_4$ of that of the valve. End nodules strong, the raphe-end very low; inner nodules all but visible. Striae not quite regular, perpendicular to the margins. Valve robust, flat, with broadly rounded margins. Fig. 4: 153.

E. arcus f. *α.* 35—50×3—4; str. 13—14. Arcued; margins parallel; ends dorsally capitate, rounded, at times higher than the median part of the valve. The valve robust, with margins strongly rounded. Fig. 4: 152.

E. jemtlandica (Font.) n. sp. 60—130×9—12; str. 10—14. Slightly arcued; margins parallel. Ends more or less distinctly bilaterally inflated, broadely rounded. End nodules strong; inner nodules generally indistinct visible. The raphe rather low in valvular view. Striae very coarse, not quite regular, lined, at the end nodules thickening and strongly radiating. End nodule area irregular. Side-line well visible, at least at the ends. Valve flat, but at the margins roundish. Fig. 4: 154.

E. jemtl. f. *bidens.* Syn. *E. media* A. Cl. var.? *jemtlandica* Fontell 1917 T. I: 25. Str. 13—16. Dorsal margin with a median impres-

sion. In certain cases, especially in specimens from Skye and Lewis, the inner nodules are well visible, without involving — as far as I can see — any other difference.

E. jemtl. f. α. 80×11; str. 14. The two dorsal ridges bipartited flatly. Fig. 4: 155.

For this rather well limited group I have taken up FONTELL's denomination on the type I have above called f. *bidens*. In the very rich occurrence of the species in material from Hebrides the type domineering distinguishes itself by the ends being higher than the dorsum; this applies above all to the elongated forms, which at last seem to take the shape of a tibia, while the short ones retain the conformity to the swedish type.

E. tetraodon (Ehr. Ralfs 1861) f. α. 58×18(11). The central dorsal depression about twice as deep as the other. Fig. 4: 156.

E. tetraod. f. *undosa* A. Cl.-E. in man. 1938. The two outer ridges equally divided in two by minor impressions.

E. tetraod. f. β. 56×15(12). Geniculate. Perhaps it might as well be characterized by the ventral line abnormally arched. Fig. 4: 157.

E. tetraod. f. *minuta*. 25—30×11(9); str. 8. A diminutive form of the main type, though the ends are somewhat lower. It is noteworthy that the striae have not at all increased in frequency. Fig. 4: 158.

E. diadema (Ehr. Ralfs) f. *dentata*. Dorsal ridges rather acute, the wave-thoughs rounded; ends thinned out from ventral side. — Another form nearly akin to this one has been reproduced by GEMEIN-

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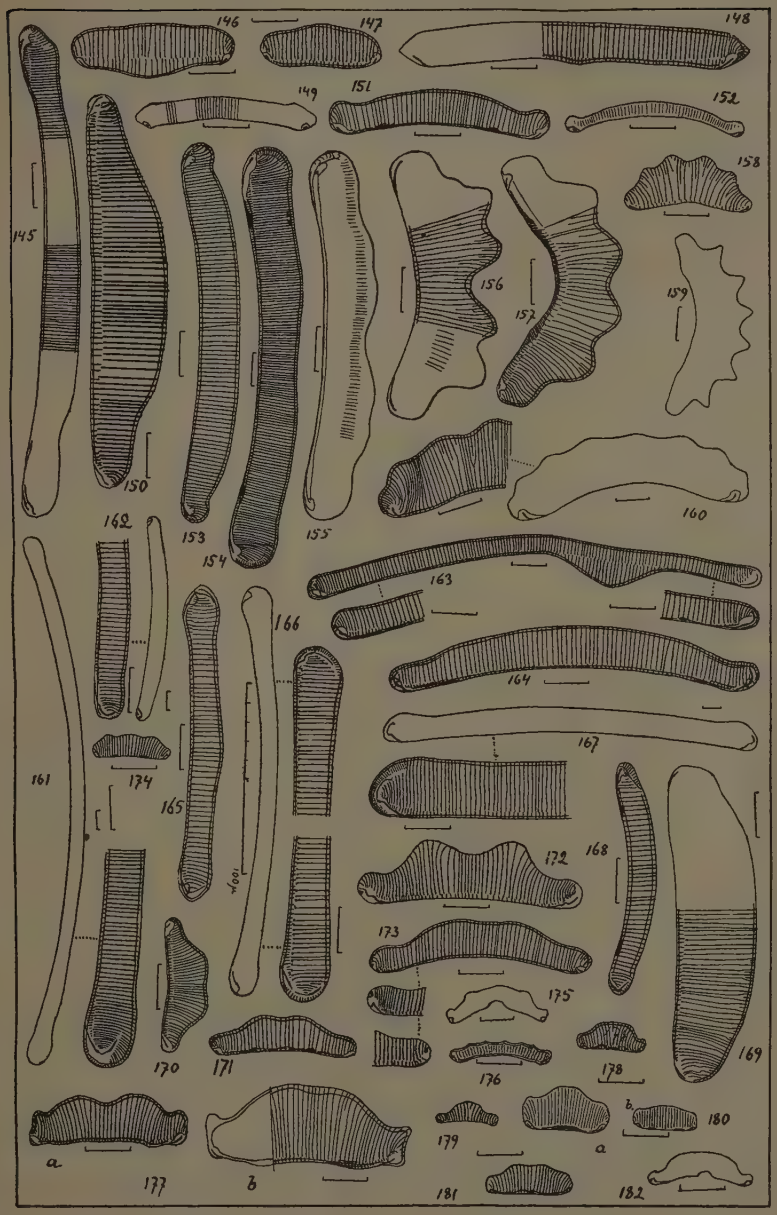
Fig. 4. 145 *E. major* f. *excelsa*, Maine. 146 *E. formica* f. α, Massachusetts. 147 *E. form.* f. β, Massach. 148 *E. form.* f. *stricta*, Soppajärvi. 149 *E. nodosa*, Örträsk. 150 *E. rostrata*, Herkinje Lake. 151 *E. arcus* f. *concinna*, Jämtland. 152 *E. arcus* f. α, Örträsk. 153 *E. arcus* f. *sphaerocephala*, Helags Fjäll. 154 *E. jemtlandica*, Isle of Lewis. 155 *E. jemtl.* f. α, Örträsk. 156 *E. tetraodon* f. α, Örtr. 157 *E. tetr.* f. β, Isle of Lewis. 158 *E. tetr.* f. *minuta*, Maine. 159 *E. diadema* f. *dentata*, Isle of Skye. 160 *E. robusta* f. α, Örträsk. 161 *E. hebridica*, Isle of Lewis. 162 *E. hebr.* f. α, Spandau. 163 *E. hebr.* f. *linearis*, Isle of Skye. 164 *E. hebr.* f. β, Spitzbergen. 165 *E. hebr.* f. γ, Småland. 166 *E. floegen*, Smål. 167 *E. floegen* f. α, French's Pond. 168 *E. Vetteri*, Lake Vättern. 169 *E. praerupta-bidens* f. *commutata* A. Cl.-E., Nuasjärvi. 170 *E. diodon* f. β, Jotunheim. 171 *E. diodon* f. γ, Bengal. 172 *E. diodon* f. *eximia*, Spitzbergen. 173 *E. diodon* f. *abnormis*, Bengal. 174 *E. bactriana* f. α, Örträsk. 175 *E. bactr.* f. *geniculata*, Örtr. 176 *E. norvegica*, Jotunheim. 177 *E. praerupta-bidens* f. *compressa*, *a* Florida, *b* Finnish Lappm. 178 *E. praerupta-minor*, Örträsk. 179 *E. pr.-minor* f. α, Örtr. 180 *E. pr.-minor* f. *polaris*, *a* Jotunheim, *b* Herkinje Lake. 181 *E. pr.-minor* f. β, Örträsk. 182 *E. septentrionalis* f. *geniculata*, Örtr.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HARDT (1935) fig. VIII: 85 from Bergen: the dorsal ridges and the wave-throughs are equally acute. Fig. 4: 159.

One *E. diadema*-type which on account of its denser striation falls out of the range of this species, is reproduced in HUSTEDT (1924) T. 19: 6 under the name of the species. It shows 15 striae and thus ought to form a species of its own.

E. robusta Ralfs f. *quaternarius*. A typical *E. robusta* but with only four ridges.

One diverging type of *E. robusta* I have noted in diatomaceous earth from Maine: dorsal margin strongly arcued, with 8 ridges; ventral margin straight, with the median part slightly concave. Striae 12. For the rest I have not seen any noteworthy variations but the following, which has been advanced on account of the great stability in the building of the dorsal ridges in the main form, and from which this form makes an isolated exception.

E. rob. f. α. 60—105×12—14; str. 10—13. The distance between the dorsal ridges conspicuously larger than in the main type, c:a 13 μ. No transitional forms between these two types have been noted as yet. Fig. 4: 160.

Sub-tribe *Appendicae*.

E. hebridica n. sp. 140—325×6 $^1/_2$—8 $^1/_2$; str. 9—10. Slightly arcued; margins parallel, ends uni- or bilaterally inflated, rounded. Valve robust, with broadly rounded margins. End nodules strong, inner nodules hardly visible. End nodule area large and irregular, generally boarded against the end of valve by a narrow line of striae. Raphe at the apical axis bent backwards, at a right angle or rounded, the upper branch running parallel with the margin. Striae coarse, of *major*-type, almost regular, at the ends tightening and curved. Sideline visible. — Most probably this species holds several forms, which ought to be separated; seldom one finds two specimens showing the identical raphe. — From the same locality as the above given, Isle of Lewis, I have noted one form with the median part of the valve depressed. According to my reproductions of this type the ends of the valve with their characteristic striation and bend upward they remind rather much of *E. Grunowi* f. ε. Fig. 4: 161.

E. hebr. f. α. C:a 100×6—7; str. 8 $^1/_2$—9 $^1/_2$. Slightly arcued with parallel margins; ends rounded, not detached or inflated. Margins roundish. End nodules less coarse, the raphe like that of the main type. Fig. 4: 162.

E. hebr. f. *linearis*. 134×6 $^1/_2$; str. 9—10. Corresponds to the main type, but the ends not inflated. At times furnished with an uncommonly strong ventricosa-formation, conic. Fig. 4: 163.

E. hebr. f. β. 70—90×9; str. 10. Valve strongly reminding of that of *E. major* f. α. Ends softly detached dorsally and with strongly rounded margins. Fig. 4: 164.

E. hebr. f. γ. Str. 9. Valve of *E. formica*-type, but with margins stronger rounded. Striae visibly lined. Fig. 4: 165.

E. floegen n. sp. 150—200×7—8; str. 8. Arcued, with margins parallel; ends softly inflating, club-shaped, rounded. End nodules strong, inner nodules not visible. The raphe with its appendix scythe-like with a pronounced axial bend at the beginning of the appendix, at times somewhat immersed, so as to be visible only by deeper focussing. Striae coarse, lined. The space between the raphe and the valve's end covered with very fine radiating and punctated striae. A linear hyaline space parallel to the margin continues for a little way from the end of appendix. Side-line well visible, marked by a row of coarser pores, as in *E. major*. Valve strongly rounded. Fig. 4: 166.

E. floegen f. α. 150—250×13; str. 10—11. Differs from the main type by the ends only inflated dorsally, obliquely rounded. Striae strictly parallel. No row of coarser punctæ at the side-line. Fig. 4: 167.

E. vetteri n. sp. 50—60×6; str. 9—10. Arcued; valve flattened. Margins parallel; ends not or imperceptibly detached, rounded. End nodules very coarse, inner nodules well visible. Striae sharp, parallel, heterodistant. Side-line not visible. The appendix, divided from the raphe-end by a very short immersion, runs straight-lined backwards and upwards to the immediate proximity of the dorsal margin. The space between the appendix and the margin of apex covered by radiating striae. Fig. 4: 168.

Group 2. *Praeruptae-bidens.*

E. praerupta-bidens (Gr. emend.). V. H. Syn. T. XXXIV: 20= *E. praerupta* var. *bidens* Gr. 35—90×10—17; str. 10—14. Dorsal margin strongly arcued with a gentle (1—1 $^1/_2$ μ) depression in the centre. Ends in varying manner detached dorsally; their outer side more or less square-cut — slightly concave. Ventral margin straight or imperceptibly concave. The valve very robust, flat with broadly rounded margins. On account of that, the nodules and the raphe, lying very low, are difficult to observe. The end nodule area generally occupies the whole lower corner of the end. Side-line not well visible.

Striae more aequidistant than in *E. praer.-monos;* dorsal striae do not or by exception occur.

E. praer.-bid. f. *simplex* (Hust.). Syn. *E. arctica* Hust. var. *simplex* (1937 p. 169 fig. 4). 25—30×6; str. 16. Arcued, with parallel margins. Ends dorsally inflated, their outside rounded. Side-line well visible.

E. praer.-bid. f. *commutata* A. Cl.-E. 1938 in man. 24—110× $9\,^1/_2$—18; str. 10—12. Ventral margin slightly concave; dorsal margin strongly arcued, with or without the slight median depression. Ends not or indistinctly detached dorsally, their outside rounded. Side-line low but visible. Striae fine, sharp, irregular; dorsal striae rather richly. The striae, tightening in bundles towards ends, there begin curving in a manner minding of *E. lapponica,* with the very apex as centre. Valve flat, the marginal rounding considerably smaller than in the main type.

E. praer.-bid. f. *compressa.* Syn. *E. praer.* var. *bidens* f. *minor* Gr. (V. H. Syn. T. XXXIV: 22). A charged type of the main form: the dorsal depression 2 μ, the ends abruptly dorsally detached, their outer sides concave; end nodules slightly protruding, ventral margin with distinct heels. — This form, as well as the following, has been advanced for expressing samples on branchings from the mutual main type. Fig. 4: 177.

E. praer.-bid. f. *muscicola* (Boye P.). 35—50×9; str. 12. A parallel form to *E. praer.-mon. f. muscicola.* Dorsal margin with the feeble depression of the main type.

E. praer.-bid. f. *polaris.* 12—20×8—11; str. 11—14. A parallel form to *E. praer.-mon.* f. *polaris.* The valve forms a lying rectangle with corners rounded; the dorsal median inflation softly rising above. Side-line high; nodules extremely small.

E. diodon Ehr. f. α. 35—45×7—8; str. 16—19. Corresponds to f. *bidentula* (W. Sm.), but with denser striation.

E. diod. f. β. 30×9; str. 14—18. Dorsal line very high, compressed, the median depression very flat. Ends narrow, not inflated. Ventral margin straight — imperceptibly concave. Side-line high; striae regular, radiating out from centre, and curved. Fig. 4: 170.

E. diod. f. γ. 15—50×4—9; str. 10—13. Dorsal margin imperceptibly — rather strongly divided in two ridges. Ends more or less tapering, rounded, of about $^3/_4$ of the height of valve. Inner nodules generally visible. Striae irregular, feebly radiating. Side-line scarcely visible. Fig. 4: 171.

Diverging forms:

E. diod. f. *abnormis.* 45—55×8; str. 12. Like an arcued E. diod. f. diminuta, but differs by the curious shape of the raphe-end. It appears in valvular view as a short line more or less at a right angle to the common direction. Divergent shapes have been noted, at times heteromorph; it is most difficult to unravel, on account of the placing of the raphe-end, but undubitable the raphe is in some manner singularly built. — End nodule area large, covering the lower half of apex. Fig. 4: 173.

E. diod. f. *eximia.* 45—55×14(10); str. 11. Dorsal margin divided by two rounded ridges, steeply falling towards ends. These are extended horizontally, not inflated, rounded. End nodules strong, inner nodules not visible. Side-line well visible. The raphe-end somewhat elongated by a twice-fractioned line. The end nodules area covers the larger part of apex. Striae rather coarse, perpendicular to the side-line, their upper ends curving as to meet the undulating dorsal line at a right angle; at the ends strongly curved. Fig. 4: 172.

E. bactriana Ehr. f. α. 17—32×5—6 $^1/_2$. No necks; the ends square-cut, not inflated. — Every transitional forms occur between this and the main type. Fig. 4: 174.

E. bactr. f. *geniculata.* Valve genuflexed, and at the same time ventral margin with a semi-circular sharply limited incision. Fig. 4: 175.

E. norvegica n. sp. 10—25×3—5; str. 13—17. Slightly arcued, with margins parallel. Dorsal margin in the shortest forms smooth — slightly inflated, in the elongated forms divided by 2—5 undulations or dents. Ends rounded, of the same height as the valve. End nodules rather strong, inner nodules feebly visible. Striae coarse, distinctly lined. Valve robust, with roundish margins. — It is only the unusually coarse striae, which beside their very distinct transverse lining, most uncommon among such minute forms of *Eunotia,* that has induced me to place this characteristic species here. Yet it stands rather isolated, though it may be apprehended as a parallel form to *E. crista galli.* Fig. 4: 176.

Group 3. *Praeruptae-minor.*

E. praerupta-minor n. sp. 8—17×3—6 $^1/_2$; str. 15—18. Small, bulky forms with margins rounded, and the dorsal margin strongly arcued; ventral margin more or less concave. Ends rounded, feebly detached dorsally. Raphe very low — invisible in valvular view.

Inner nodules visible or not. Striae coarse, radiating from centre, generally with some dorsal striae at median part. Side-line indistinct. Fig. 4: 178.

E. praer.-min. f. α. 13×3 1/2—4 1/2; str. 16—17. Dorsal line helmet-shaped with a distinct central point. Ends extended horizontally, feebly or not inflated dorsally, rounded. Ventral margin almost straight. Fig. 4: 179.

E. praer.-min. f. *polaris*. 14—20×5—10; str. 16—17. A parallel form to the f:ae *polaris* in the preceding groups. Inner nodules visible; striae strictly parallel. Fig. 4: 180.

E. praer.-min. f. β. 19×6; str. 15—16. Corresponds to the main type, but dorsal margin with distinct median depression of about 1/2—1 μ, and ventral margin almost straight. Fig. 4: 181.

E. septentrionalis Østr. f. *geniculata*. Corresponds with the main type, but the valve geniculated, and at the same time ventral line with a median semi-circular incision sharply limited. Fig. 4: 182.

E. septent. f. α. 12×3 1/2; str. 15. Margins parallel and slightly arcued. The neck appears as a sharply limited 1/3-circle; ends of the same height as the valve, rounded, with a rounded passing on to the ventral side. Striae delicate. Fig. 5: 183.

E. praerupta-nana n. sp. 6—12×2 1/2—4 1/2; str. 19—24. Short and bulky forms with the median dorsal margin elevated; ends rounded, ventral margin straight — concave. End nodules end-placed, subjacent; inner nodules rarely discernable. Side-line generally not visible. Striae relatively coarse, radiating, at times arcued. The high forms often with one short dorsal striae. Fig. 5: 184.

E. praer.-nana f. α. Striae 25+. Only one type has been particularly observed and reproduced; the number of striae was 26. Fig. 5: 185.

Surely this species *E. praer.-nana* is composed of a number of separate unities, and then it would be worth the trouble trying to unravel them. Among the forms numbered to this species one finds representatives for a good many of types treated above, though diminutive and densely striated.

Tribe VII. *Breviraphidae.*

E. zygodon (Ehr.) emend. 40—120×9(7)—15(12); str. 5 1/2—9 1/2. Arcued; valvular plane vaulted feebly but evenly. Dorsal line with two rounded ridges; ends in the elongated forms inflated club-like.

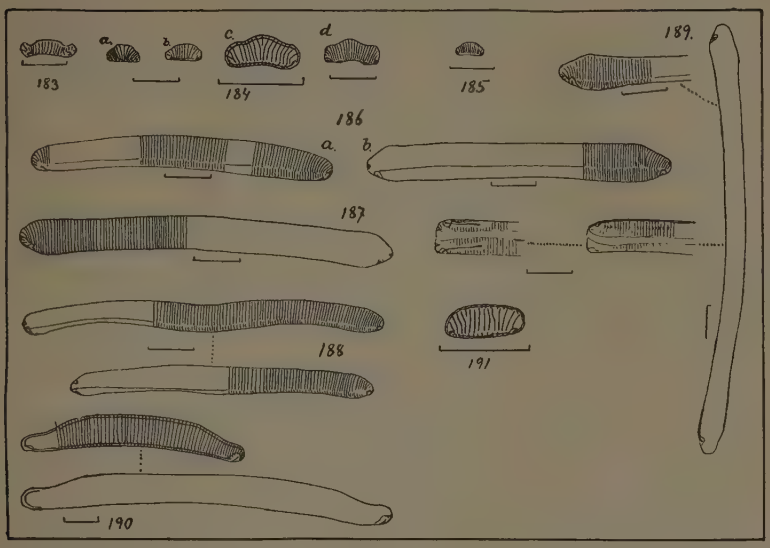

Fig. 5. 183 *E. septentrionalis* f. α, Örträsk. 184 *E. praerupta-nana, a—c* Örträsk, *d* Hudson River. 185 *E. pr.-nana* f. α, Örträsk. 186 *E. batavica, a* Bengal,, *b* Rio Negro. 187 *E. bat.* f. α, Rio Negro. 188 *E. bat.* f. β, Rio Negro. 189 *E. bat.* f. γ, Florida. 190 *E. Grunowi* f. *uplandica* A. Cl.-E., Gottsunda, Uppland. 191 *E. ovata* f. α, Örträsk.

Side-line in the main type unusually high. The ventral raphe short and coarse, almost straight, parallel to the margin of the valve. End nodules subjacent, slightly withdrawn. Striae rather sharp; generally very much irregular, easily dissolved in its constituents; towards ends rather abruptly tightening, and strongly arcued by the end nodules.

This form includes »*E. clavata*» Hust. (A. S. Atlas T. 289: 14, 15).

E. zyg. f. α. 40—70×9(7)—12(9); str. 10—14. Forms a direct continuation of the main type, with denser striation.

E. zyg. f. β. Syn. *E. zygodon* Ehr. (A. S. Atl. T. 287 fig. 4—15). 40—160×10(7)—40(37); str. 7 $^1/_2$—12. Strongly varying as to outline, but essentially like the main type. Side-line lacking.

E. zyg. f. γ. 80×13(11); str. 13—16. A direct continuation of f. β. Striae regular, no dorsal striae. Side-line not visible. The valve flattened, with a shorter rounding of margins than in the sparsely striated forms.

Tribe VIII. *Stigmaticae.*

E. batavica n. sp. Syn. *E. parallela* Ehr. (Grunow 1865 s. 3 fig. I: a—c). 40—110×7—9; str. 15—18. Valve flat, with shortly rounded margins. Lineal, feebly arcued — straight. Ends rounded — cuneiform, obtusely acuminated. Raphe short, well-nigh or not at all visible in valvular view; the ventral part quite straight. End nodules on the lower side of apex. Generally one tap-shaped pore is visible in each end, most often placed in the very apex. — Striae fine, not sharp, regular and parallel, arcued at the ends. Side-line very high, often difficult to observe because of the striae corresponding against each other. Fig. 5: 186.

E. bat. f. α. Dimensions and striation as the main type, from which it differs by the side-line running along the ventral margin to the greatest part of its length. Fig. 5: 187.

E. bat. f. β. The valve impressed in the middle or furnished only with a ventral embossment. The side-line lower than in the main form, running parallel to the dorsal margin. Fig. 5: 188.

E. bat. f. γ. Ends symmetrically cuneiform with square-cut apices. Stigmata feebly developed are sometimes at hand along the margins. Fig. 5: 189.

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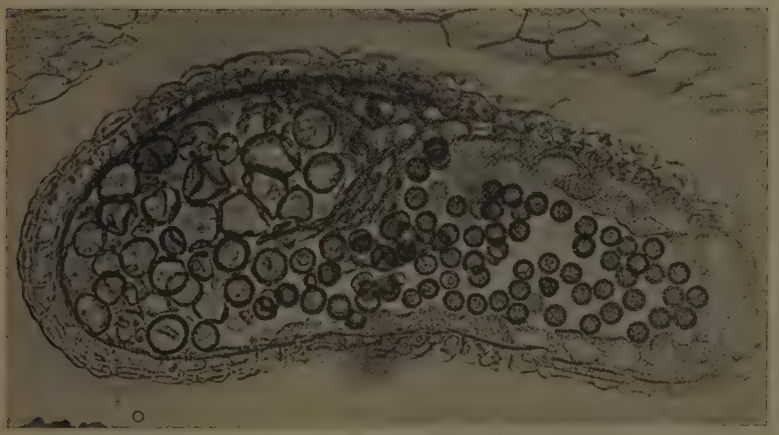
Smärre uppsatser och meddelanden.

Abnorm utformning av pollen inom ett pollenfack av Beta.

Under cytologisk kontroll av ett stort antal i växthus vinterodlade fröplantor av sockerbeta påträffades i mars 1938 hos en planta en abnormitet i pollenbildningen, som visar en del intressanta drag och fördenskull förtjänar ett omnämnande.

I plantan 1938: 16: 5, en representant för en av de relativt inavlade linjer, som användas för uppbyggandet av Hilleshögs handelsfrö, visade samtliga pollenkorn inom ett pollenfack en synnerligen abnorm utformning. Denna företeelse var helt begränsad till detta pollenfack och ingenting dylikt förefanns i det 20-tal pollenprov från olika delar av plantan, som undersöktes, sedan denna abnormitet påträffats. De övriga blommorna i samma blomställning liksom de 4 övriga ståndarna i samma blomma voro helt normala. I vissa blommor pågick meiosis och visade 9 bivalenter av normalt utseende.



Abnormitetens karakteristiska utformning framgår av mikrofotot å figuren. Detta visar ett något snett skuret 12 µ tjockt längdsnitt av en ståndarknapp. Mitt på bilden något till vänster synas lämningarna av skiljeväggen mellan de båda pollenfacken. Som ofta händer är denna vägg delvis söndersliten. Det på bilden högra pollenfacket innehåller betpollen av normalt utseende och synbarligen av god kvalitet (nära 100 % gott pollen). I det vänstra pollenfacket åter är bilden helt annorlunda. Detta pollenfack är fyllt av celler av mycket olika storlek och form. De flesta äro monstruöst uppsvällda och

upptill 50 gånger större i volym än normala pollenkorn; dock förekomma dessutom talrika mycket små celler.

Tabell 1. Pollendiameter.

	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1. Normala	—	—	—	1	19	67	13	—	—	—	—	—	—	—	—	—	—	—	—
2. Gränsområdet ...	—	—	—	—	—	6	23	22	9	7	10	5	7	1	3	3	1	1	—
3. Abnorma	1	2	2	1	—	2	6	1	2	2	4	4	5	5	5	4	3	6	6
4. Beta trigyna.....	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	10	6	4	2

	27	28	29	30	31	32	33	34	35	36	37	40	42	45	Medeltal
1. Normala	—	—	—	—	—	—	—	—	—	—	—	—	—	—	12,92±0,06
2. Gränsomr ådet...	2	—	—	—	—	—	—	—	—	—	—	—	—	—	16,67±0,31
3. Abnorma	8	4	5	5	3	3	2	2	1	2	1	1	1	1	23,98±0,75
4. Beta trigyna	—	—	—	—	—	—	—	—	—	—	—	—	—	—	23,64±0,38

Dessa abnormt utbildade celler fylla helt ut pollenfacket och äro mosaikformigt inpassade i varandra. I själva verket ha de utövat tryck på ståndarväggen, vilket haft till följd att detta pollenfack är avsevärt uppsvällt, jämfört med de övriga pollenfacken i samma ståndare.

Troligen ha dessa celler genomgått meiosis, i vissa fall kunde nämligen en tetradanordning iakttagas, de få alltså betraktas som pollenkorn. De mest monstruösa av dessa jätteceller ha dock ej någon vidare likhet med pollenkorn. Väggarna äro visserligen något förtjockade, men det för betpollen typiska väggmönstret saknas. De flesta av dessa celler synas tomma eller innehålla skrumpnad plasma, någon gång synes även en cellkärna. Dylika celler uppta största delen av pollenfacket. Mot gränsen av det normala pollenfacket ser man emellertid i varje snitt några jätteceller av ett annat mer lagbundet utseende. De likna fullständigt stora pollenkorn, färga sig på samma sätt som normalt pollen, innehålla levande plasma och ha det karakteristiska väggmönstret. Tyvärr är det omöjligt att avgöra, om dessa korn verkligen tillhöra det abnorma pollenfacket, eller om de härstamma från det normala. De ligga nämligen i alla snitten i själva öppningen mellan de båda pollenfacken.

Av visst intresse är, att pollenkorn som med säkerhet höra till det normala pollenfacket men ligga invid skiljeväggen, överlag förete större diameter än pollenkorn från andra delar av samma pollenfack. Tab. 1 ger måtten i μ på diametern av pollenkorn dels från ytterväggen av det normala facket (1), dels från gränsområdet mellan de båda facken (2) och dels från det abnorma facket (3). Det synes vid första blicken på denna tabell, att pollenkornen i grupp 2 ha en annan storlek än i grupp 1. Medeltalen för de båda grupperna utgöra 17 resp. 13 μ. Inom grupp 2 har majoriteten pollenkorn obetydligt större diameter än normalt (13—16 μ), men dessutom förekomma talrika

mycket stora pollenkorn (diameter upp till 27 µ). I denna grupp ha endast medtagits pollenkorn, som ha normalt, livsdugligt utseende. I grupp 3 av tabellen ha pollenkorn, slumpvis uttagna i det abnorma pollenfacket mätts. Variationen i längd är här mycket stor (8—45 µ). Som jämförelse meddelas dessutom några mått på pollenkorn från den hexaploida arten *Beta trigyna,* vars pollenlängd, som man kan vänta, ligger betydligt högre än normal *Beta vulgaris.*

Hur denna abnormitet i pollenutvecklingen uppkommit låter sig naturligtvis ej fastställas. Observeras bör, att samtliga celler i hela pollenfacket ha abnorm utformning. Vad som har inträffat bör alltså föras tillbaka till en förändring inom de subepidermala celler, som givit upphov till arkesporiet. Möjligen är det fråga om en ökning i kromosomantalet med åtföljande cellförstoringar. Troligare är väl dock att på ett eller annat sätt t. ex. genom en yttre påverkan eller genom en genmutation den utvecklingsmekaniska jämvikten rubbats, varvid denna celltillväxt stimulerats. Härpå tyder även det påpekade förhållandet, att pollencellerna i det bredvidliggande pollenfacket visade en tydlig tendens till ökning i storlek.

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ALBERT LEVAN.

Nytt fynd av Cuscuta arvensis Beyr. var. calycina Engelm.

Invid den gamla tegelbruksgraven vid Weibullsholm, Landskrona, befanns innevarande sommar ett mindre område med klöver och diverse andra växter vara svårt angripet av *Cuscuta.* Vid närmare granskning visade det sig att den här uppträdande *Cuscuta*-arten var till sina morfologiska egenskaper fullständigt överensstämmande med den *Cuscuta arvensis* Beyr. var. *calycina* Engelm., som SYLVÉN beskrev i Botaniska Notiser, 1937, sid. 291.

SYLVÉNS fynd var det första, då nämnda art anträffats växande i vårt land, trots att frön av densamma ofta blivit funna i importerade frövaror och alltså flerfaldiga gånger blivit utsått (se WITTE, Svensk Botanisk Tidskrift, 1936; sid. 661). Den av SYLVÉN beskrivna växtplatsen var belägen vid Örja kyrkby, Landskrona, endast ett par km från Weibullsholm. *Cuscuta* växte här talrikt på ett fält besått med luzern. Fyndet vid Weibullsholm är alltså andra gången *Cuscuta arvensis* Beyr. var. *calycina* är påträffad som adventivväxt i vårt land. Då därtill en del anteckningar här kunde göras om artens uppträdande som parasit på olika växter, syntes det oss finnas anledning att publicera detsamma.

Platsen, där fyndet gjordes, har utgjort en avstjälpningsplats för avfallsfrö från renserierna. Hela det angripna områdets yta utgjorde c:a 25 kvm. Säkert har därför *Cuscuta* här inkommit med avfallsfrö av leguminoser. Centrum av angreppsområdet var huvudsakligen beväxt med *Trifolium repens, hybridum* och *pratense.* Dessa voro till stor del förintade genom angreppet. Från detta spridningscentrum hade *Cuscuta* utbrett sig till i periferin växande arter av även andra familjer. Inom hela området antecknades följande arter, som mer eller mindre svårt angripna.

Artemisia vulgaris
Capsella bursa pastoris
Lamium album
Chenopodium album
Lepidium ruderale
Lotus corniculatus
Matricaria inodora
Medicago lupulina
Plantago major
Polygonum amphibium
P. aviculare
P. convolvulus
Solanum nigrum
Trifolium hybridum
T. pratense
T. repens
Urtica dioeca

Inom *Cuscutas* utbredningsområde, men huvudsakligen i kanterna, växte dessutom följande arter utan att vara angripna. Visserligen kunde man finna att *Cuscuta* slingrat sig om och utbildat haustorier på en del gräsplantor, men den förmådde ej kvarleva på dem, utan vissnade så småningom bort.

Atriplex sp.
Agropyrum repens
Dactylis glomerata
Lappa tomentosa
Lolium perenne
Phleum pratense
Phragmites communis
Poa pratensis

Landskrona den 9 september 1938.

ARVID NILSSON och ERIK ÅKERBERG.

Notiser.

Professor N. H. Nilsson-Ehle har av Vetenskapsakademien utsetts till dess representant vid den sjunde Internationella genetiska kongressen 23—30 augusti 1939.

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